THE FOUNDRY

Vol. 43 No. 9

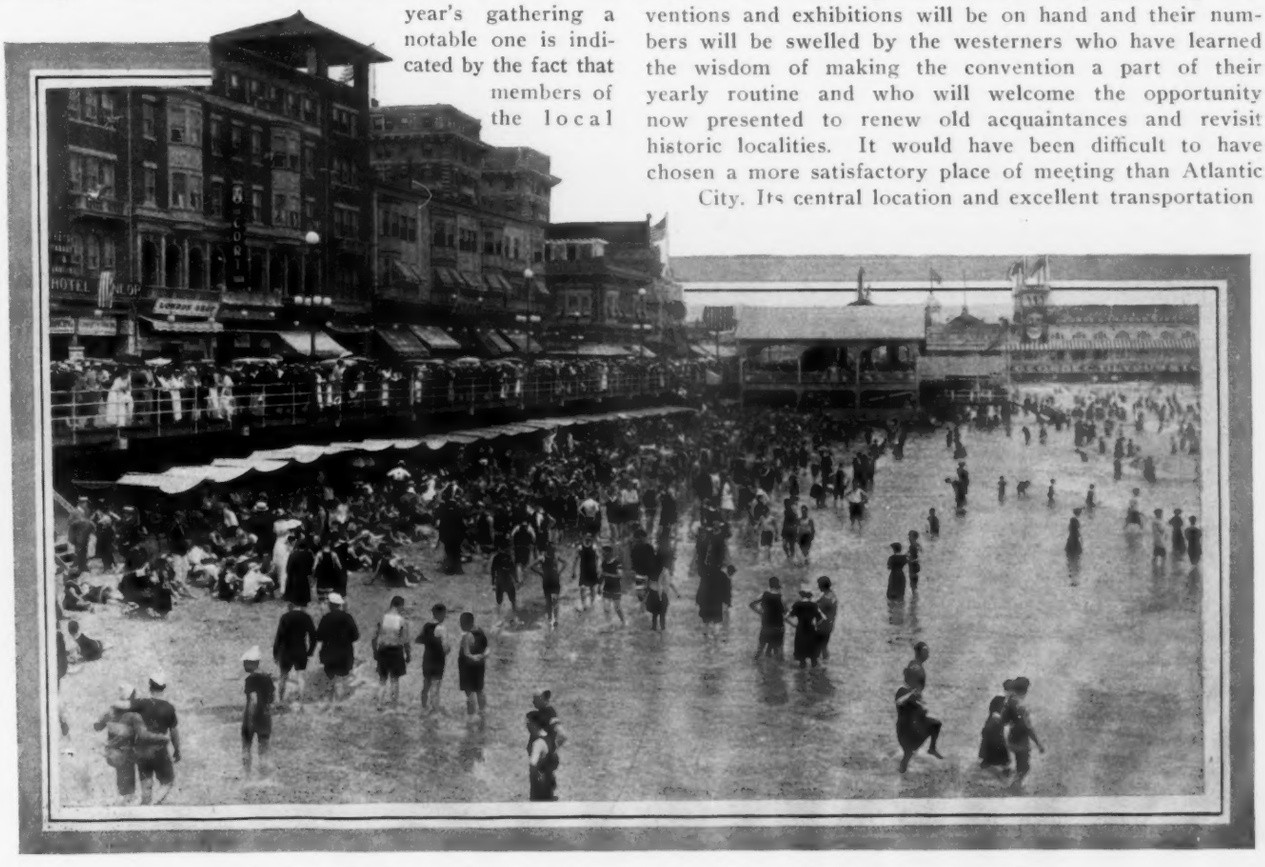
Whole No. 277

Cleveland, Ohio, September 1915

The Foundrymen's Meeting at Atlantic City

Programs of Unusual Merit Have Been Prepared by the American Foundrymen and Institute of Metals—Entertainment Features

SINCE the last convention of the allied foundry organizations east of the Allegheny mountains eight years have elapsed, but once more all eyes are turned toward the Atlantic seaboard. This year Atlantic City has been selected as the place of meeting and the foundrymen of the whole eastern section of the country will act as hosts, returning the hospitality of Toronto, Cincinnati, Detroit, Pittsburgh, Buffalo and Chicago. That the entire east is united to make this year's gathering a notable one is indicated by the fact that members of the local committee, in charge of affairs at Atlantic City, have been chosen from six different states, Pennsylvania, New Jersey, New York, Connecticut, Rhode Island and Massachusetts. That the western foundrymen will respond nobly to the invitation of their eastern compatriots goes without saying. The attendance at the approaching meeting will undoubtedly be large and many new faces will be seen.. Eastern foundrymen who found it impossible to make the trip to the immediately preceding conventions and exhibitions will be on hand and their numbers will be swelled by the westerners who have learned the wisdom of making the convention a part of their yearly routine and who will welcome the opportunity now presented to renew old acquaintances and revisit historic localities. It would have been difficult to have chosen a more satisfactory place of meeting than Atlantic City. Its central location and excellent transportation



ON THE BEACH AT ATLANTIC CITY—AMERICA'S GREATEST SEASIDE RESORT

facilities make it accessible to all; its proximity to such large foundry centers as Philadelphia and New York gives every opportunity to those who are interested in visiting plants and inspecting industrial operations; the number, variety and appointments of its hotels are such as to insure comfortable accommodations for every visitor; the recreation and amusement features leave nothing to be desired, while the facilities for holding the exhibition and conducting the professional sessions of the allied societies are complete in every detail.

At the various sessions of the American Foundrymen's Association and the American Institute of Metals 63 papers and reports will be presented and discussed. In quality and variety the papers are fully equal to those presented at previous meetings and the programs have been arranged to stimulate the fullest possible discussion. Both societies will hear the reports of committees that have been at work throughout the year, and it is expected that an unusual volume of valuable foundry information and data will become available through this source. The exhibition will have the advantage of an ideal location which precludes the possibility of overcrowding and inconvenience and affords unusual facilities for the display of working equipment. The entertainment features of the week will be unique and of a character such as can only be found at Atlantic City.

The tenth annual foundry and machine exhibition, under the auspices of the Foundry & Machine Exhibition Co. will open Saturday morning, Sept. 25 and close Friday evening, Oct. 1. The exhibition will be held on Young's Million Dollar pier, an immense steel and concrete structure which extends for 1,700 feet into the Atlantic ocean.

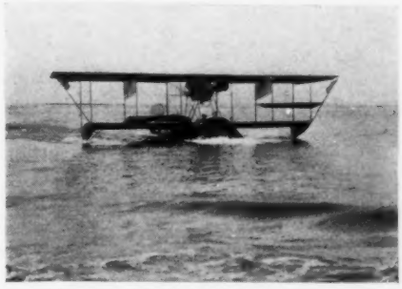
The convention proceedings will open at 10 A. M. Tuesday, Sept. 28, with a joint meeting of the American Foundrymen's Association and the American Institute of Metals, which will be held in the convention hall at the outer end of Young's pier. The registration bureaus for both associations, which will be located on the pier, will open Monday morning, Sept. 27. The headquarters of the American Foundrymen's Association and the American Institute of Metals will be at the Hotel Traymore, the latest addition to Atlantic City's galaxy of hostelries. The headquarters for the exhibition company will be at the Hotel Dennis.

Thursday, Sept. 30, has been set aside as "Philadelphia Day" and an effort will be made to close all Philadelphia foundries on that day to enable their employes to attend the convention and exhibition. Under the auspices of the Philadelphia Foundrymen's Association a special train will be run from the Quaker City to the seashore. The annual joint banquet of the American Foundrymen's Association and the American Institute of Metals will be held Thursday evening, Sept. 30, in order to give as many of the Philadelphia visitors as possible an opportunity to attend.

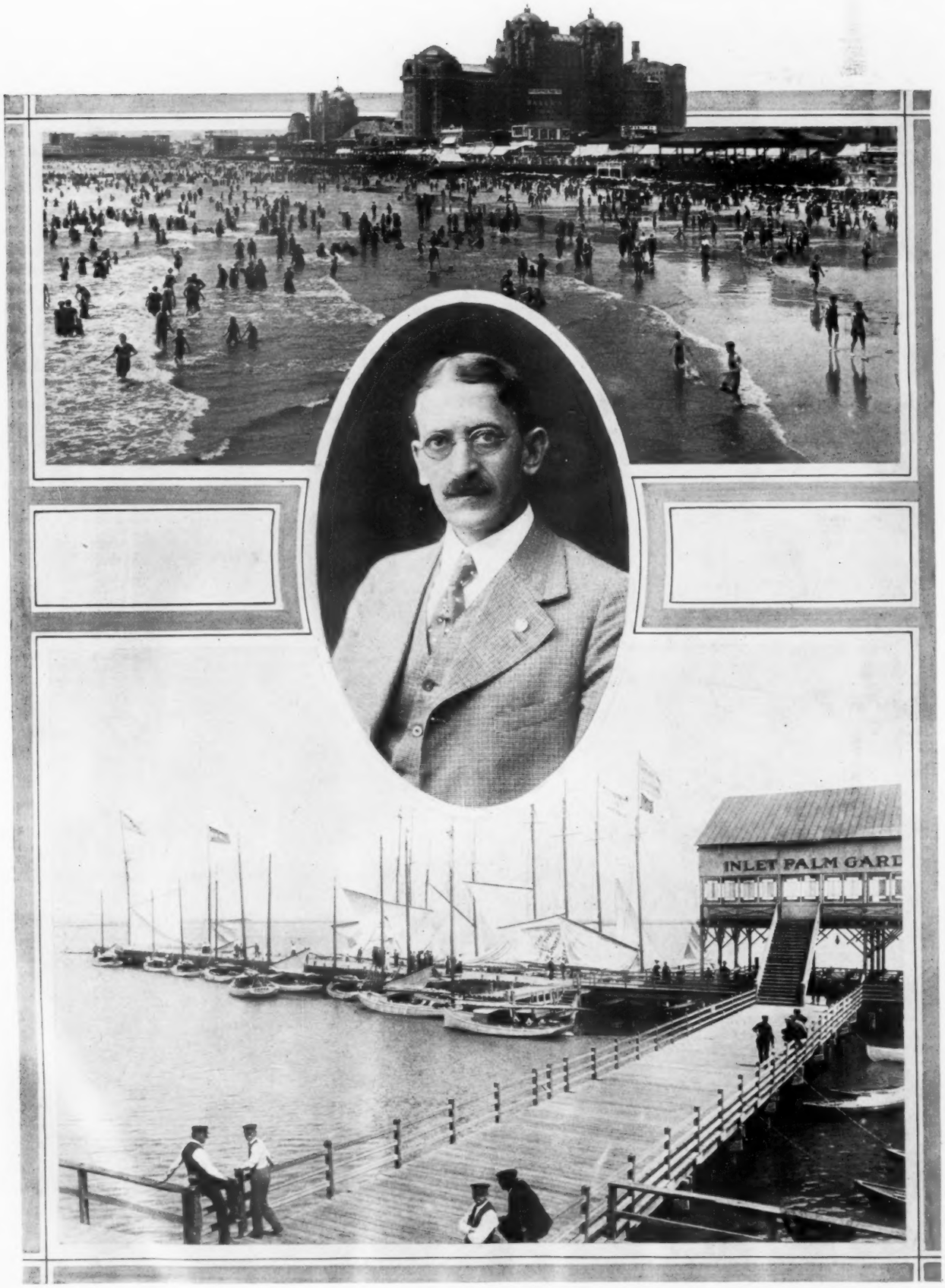
The detailed programs of the American Foundrymen's Association and the American Institute of Metals are published on pages 337 and 338, respectively. The programs have been carefully compiled, and as far as possible related subjects will be presented at each session to facilitate discussion and for the convenience of those in attendance. Foundrymen interested only in certain special lines of work will find it possible to obtain full information regarding the subjects in which they are particularly interested without attending all of the sessions; but one joint professional session will be held, on Tuesday morning, Sept. 28. At that time the usual addresses of welcome and response will be delivered, together with a number of important papers and reports on subjects of general interest.

The American Foundrymen's Association will introduce an innovation by holding its annual business meeting on

THE FAMOUS BOARDWALK BUILT ON THE UNPROTECTED SHORE OF THE ATLANTIC OCEAN



YOUNG AND OLD, FAIR AND FADED, FLOCK TO THE BOARDWALK
THE ATLANTIC OCEAN LAPS AT THE VERY FOUNDATIONS OF THE BIG CARAVANSERIES



THE BEACH WITH HOTEL TRAYMORE, HEADQUARTERS FOR A. F. A. AND A. I. M. IN THE BACKGROUND
R. A. BULL, PRESIDENT A. F. A.
AFTER A DIP IN THE BREAKERS COMES A SAIL IN STAUNCH COASTING SLOOPS

Program, American Foundrymen's Association

Tuesday, Sept. 28, 10 a. m. Convention hall, Young's pier

Joint session, American Foundrymen's Association and American Institute of Metals.

Addresses of welcome and response.

Report of A. F. A. committee on safety, by A. W. Gregg, chairman, Bucyrus Co., South Milwaukee, Wis.

"Tests of Lenses for Foundry Goggles", by F. W. King, Julius King Optical Co., New York. This address will be accompanied by a demonstration of a lens testing machine and a colored spectrascopic test showing scientifically, colors of lenses used in dangerous conditions of light and glare.

Report of A. F. A. committee on industrial education, by Frank M. Leavitt, chairman, University of Chicago, Chicago.

"Functions of Sand Binders", by Henry M. Lane, consulting foundry engineer, Trussed Concrete Bldg., Detroit.

"Notes on Applications and Characteristics of Cores in Modern Molding", by R. A. Bull, Commonwealth Steel Co., Granite City, Ill.

"Molding Sands", by C. P. Karr, associate physicist, Bureau of Standards, Washington, D. C.

Appointments of nominating and resolutions committees.

Tuesday, Sept. 28, 2:30 p. m. Convention hall, Young's pier

Report of A. F. A. committee on specifications for foundry scrap, by S. D. Sleeth, chairman, Westinghouse Air Brake Co., Wilmerding, Pa.

"Patternmaking for Molding Machine Work", by E. I. Chase, Cadillac Motor Car Co., Detroit.

"Foundations for Jar-Ramming Molding Machines", by E. S. Carman, Osborn Mfg. Co., Cleveland.

"The History and Development of the Molding Machine with Sidelights on Latter-Day Practice", by J. J. Wilson, Cadillac Motor Car Co., Detroit, and A. O. Backert, The Foundry, Cleveland.

"Scientific Management and Its Relation to the Foundry Industry", by H. K. Hathaway, Tabor Mfg. Co., Philadelphia.

"Reclaiming Molding Sand", by W. M. Saunders and H. B. Hanley, Saunders & Franklin, analytical and consulting chemists, Providence, R. I.

"The Relation of the Foundry Foreman to his Employer", by S. V. Blair, Rushville, Ind.

Tuesday, Sept. 28, 8 p. m.

Theater party for members and ladies of the American Foundrymen's Association and the American Institute of Metals.

Wednesday, Sept. 29, 10 a. m. Convention hall, Young's pier

"The Modern Foundry Advance", by Dr. Richard Moldenke, consulting metallurgical engineer, Watchung, N. J.

"Manufacture, Constitutents and Essentials in the Purchase of Pig Iron for Foundry Use", by Oliver J. Abell, The Iron Age, Chicago.

Report of the A. F. A. committee on costs, by B. D. Fuller, chairman, Westinghouse Electric & Mfg. Co., Cleveland.

"Organization in the Foundry of the University of Illinois Shop Laboratories", by R. E. Kennedy and J. H. Hogue, instructors, University of Illinois, Urbana, Ill.

"The Structural or Mechanical Theory of the Effect of Rust on Cast Iron and Wrought Iron or Steel", by R. C. McWane, publisher of The Fire Engineer, and Harry Y. Carson, Central Foundry Co., New York.

Wednesday, Sept. 29, 2:30 p. m. Convention hall, Young's pier

GRAY IRON SESSION

"Pouring Systems for Gray Iron Foundries", by H. Cole Estep, associate editor, The Foundry, Cleveland.

"Fuel Oil Cupolas", by Bradley Stoughton, consulting metallurgical engineer, New York City.

"Inspection of Automobile Castings", by C. B. Wilson, Wilson Foundry & Machine Co., Pontiac, Mich.

"Common Defects in Gray Iron Castings—Their Causes and Remedies Therefor", by Herbert M. Ramp, Elmwood Castings Co., Cincinnati.

Report of A. F. A. committee on specifications for gray iron castings, by W. D. Putnam, chairman, Detroit Testing Laboratory, Detroit.

Report of A. F. A. committee on standard methods for analyzing coke, by H. E. Diller, chairman, General Electric Co., Erie, Pa.

Wednesday, Sept. 29, 8 p. m., Hotel Traymore

ANNUAL BUSINESS SESSION

Annual address of the president, R. A. Bull, Commonwealth Steel Co., Granite City, Ill.

Report of the secretary-treasurer, A. O. Backert, Cleveland.

Report of the auditor.

Report of the nominating committee.

Election of officers.

Thursday, Sept. 30, 10 a. m. and 2:30 p. m., Convention hall and annex, Young's pier

STEEL SESSIONS

"Dynamic Properties of Steel Employed in the Manufacture of Castings of Various Types", by J. Lloyd Uhler, Union Steel Casting Co., Pittsburgh.

"The Particular Application of the Converter in the Manufacture of Steel Castings", by C. S. Koch, Fort Pitt Steel Casting Co., McKeesport, Pa.

"Notes on Electric Furnace Construction and Operation in the Steel Foundry", by James H. Gray, U. S. Steel Corporation, New York City.

"Open-Hearth Furnace Checker Design", by W. A. Janssen, Bettedorf Co., Davenport, Iowa.

"Causes of Shrinkage Cracks in Steel Castings", by William R. Bossinger, Marion Steam Shovel Co., Marion, O.

Report of A. F. A. committee on specifications for steel castings, by W. C. Hamilton, American Steel Foundries, Granite City, Ill.

Report of A. F. A. committee on steel foundry standards, by Dudley Shoemaker, American Steel Foundries, Indiana Harbor, Ind., and R. A. Bull, Commonwealth Steel Co., Granite City, Ill.

"Notes on Arc Welding", by Robert Kinkead, Lincoln Electric Co., Cleveland.

MALLEABLE SESSIONS

"Some Remarks Regarding the Permissible Phosphorus Limit in Malleable Iron Castings", by Prof. Enrique Touceda, Rensselaer Polytechnic Institute, Albany, N. Y.

"Standardization of Air Furnace Practice, by A. L. Pollard, Johnston Harvester Co., Batavia, N. Y.

"An Outline to Illustrate the Interdependent Relationship of the Variable Factors in Malleable Iron Practice", by L. E. Gilmore, Baltimore Malleable & Steel Co., Baltimore.

Paper on malleable practice, by J. P. Pero and J. C. Nulsen, Missouri Malleable Iron Co., East St. Louis, Ill.

"Coal—Its Origin and Use in the Air Furnace", by F. Van O'Linda, Consolidation Coal Co., Chicago.

Thursday, Sept. 30, 7 p. m., Hotel Traymore

Annual banquet.

Friday, Oct. 1, 10 a. m., Convention hall, Young's pier

Introduction of new officers.

Report of committee on resolutions.

Appointment of standing committees.

Unfinished business.

Wednesday evening, Sept. 29, instead of Friday morning, at the close of the meeting, as heretofore. It is believed that the new arrangement will be favorably received inasmuch as it will give the members an opportunity to become acquainted with the new officers before the convention is at an end. It also will permit the new officers to be represented officially at the annual banquet and will give the incoming administration an opportunity to get its bearings and map out the plan of campaign for the ensuing year's work of the organization. The American Foundrymen's Association will hold simultaneous technical sessions on Thursday morning and afternoon, covering the subjects of steel foundry and malleable foundry practice, respectively. The steel sessions will be held in the convention hall on Young's pier and the malleable sessions in the annex immediately adjoining the convention hall. At the two steel sessions eight papers and reports will be presented and at the malleable sessions, five. The American Foundrymen's Association will hold a final business meeting on Friday morning, Oct. 1. Following the joint session on Tuesday morning the American Institute of Metals will hold five technical sessions, one on Tuesday, two on Wednesday and two on Thursday. Papers on general topics of interest to non-ferrous metal founders will be presented at the Tuesday afternoon and Wednesday morning sessions. Aluminum and its alloys will be discussed Wednesday afternoon. The Thursday morning meeting will be devoted to acid metals and bearing bronzes and the Thursday afternoon session to forging and rolling non-ferrous alloys. The Institute of Metals will hold its meetings at the Traymore hotel.

The exhibition will cover practically all of the available space on Young's pier. In addition, as mentioned previously, the meetings of the American Foundrymen's Association will be held on the pier and it is believed that this concentration of convention and exhibition features will be mutually advantageous. Advance reports indicate that the exhibition will be unusually interesting on account of the many advances in foundry practice during the past year. Among other novel features, the Snyder Electric Furnace Co., Chicago, will exhibit an electric furnace in operation and heats will be poured twice daily. Arrangements have been made with other exhibitors to clean and machine the electric steel castings on the pier. Exceptional facilities for operating exhibits have been provided including power in any form. Electric current, both direct and alternating, will be available in various voltages; as heretofore, exhibitors of pneumatically-operated machinery will have the use of unlimited quantities of compressed air; and steam, which has not been available heretofore, will be furnished such exhibitors as desire it. From a commercial standpoint there seems little doubt but that the 1915 exhibition will be fully as successful as its predecessors, particularly on account of the unusually rich indus-

Program, American Institute of Metals

Tuesday, Sept. 28, 10:00 a. m. Convention hall, Youngs' Pier

Joint meeting with the American Foundrymen's Association. (For details see A. F. A. program.)

Tuesday, Sept. 28, 2 p. m. Hotel Traymore

GENERAL PAPERS

Report of official chemist, by Arthur D. Little, Inc., Boston.

"An Investigation of Fusible Tin Boiler Plugs", by Dr. G. K. Burgess, Bureau of Standards, Washington, D. C.

"The Influence of the Impurities of Spelter on the Cracking of Slush Castings", by Gilbert Rigg, New Jersey Zinc Co., Newark, N. J.

"Cobalt in Non-Ferrous Metals", by H. T. Kalmus, Kalmus, Comstock & Westcott, Cambridge, Mass.

"Furnace Methods for Pure Castings", by F. L. Antisell, Raritan Copper Works, Perth Amboy, N. J.

"Standard Test Specimen of Zinc-Bronze: Cu. 88, Sn. 10, Zn. 2. Relation of the Mechanical Properties to the Microstructure", by Dr. H. S. Rawdon, Bureau of Standards, Washington, D. C.

"Notes on the Copper-Rich Kalchoids", by S. L. Hoyt, University of Minnesota, Minneapolis.

Tuesday, Sept. 28, 8 p. m.

Theater party.

Wednesday, Sept. 29, 10 a. m. Hotel Traymore

"The Effect of the Present European War on the Metal Industries", by Thos. F. Wettstein, United Lead Co., New York.

"Sherardizing", by Dr. S. Trood, U. S. Sherardizing Co., New Castle, Pa.

"Electric Furnace for Brass Melting", by F. A. S. Fitzgerald, Fitzgerald Laboratories, Niagara Falls, N. Y.

"Substitutes and Alloys to Take the Place of Platinum", by W. E. Mowrey, St. Paul, Minn.

"Alloys of Nickel, Chromium and Copper", by David F. McFarland and O. E. Harder, University of Illinois, Urbana, Ill.

Wednesday Sept. 29, 2 p. m. Hotel Traymore

ALUMINUM AND ALUMINUM ALLOYS

"Aluminum Die Castings", by Chas. Pack, Doehler Die Casting Co., Brooklyn, N. Y.

"The Manufacture and Use of Alumino-Vanadium", by Wm. W. Clark, Seymour Mfg. Co., Seymour, Conn.

"Recent Advances in the Manufacture and Uses of Aluminum", by E. V. Pannell, British Aluminum Co., Toronto, Ont.

"The Welding of Aluminum", by E. V. Pannell, British Aluminum Co., Toronto, Ont.

"Aluminum Brònze Alloys", by W. M. Corse, Titanium Alloy Mfg. Co., Niagara Falls, N. Y.

Thursday, Sept. 30, 10 a. m. Hotel Traymore

ACID METALS AND BEARING BRONZES

"Development of an Acid-Resisting Alloy", by S. W. Parr, University of Illinois, Urbana, Ill.

"Methods of Analysis for Complex Alloys", by S. W. Parr, University of Illinois, Urbana, Ill.

"Effect of Zinc on Copper, Tin, Lead Alloys", by G. H. Clamer, Ajax Metal Co., Philadelphia.

"The Advantages of a Standard Railway Journal", by Russell R. Clark, Pennsylvania railroad, Pittsburgh.

Thursday, Sept. 30, 2 p. m. Hotel Traymore

FORGING AND ROLLING ALLOYS

"Forging Manganese Bronze", by Jesse L. Jones, Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

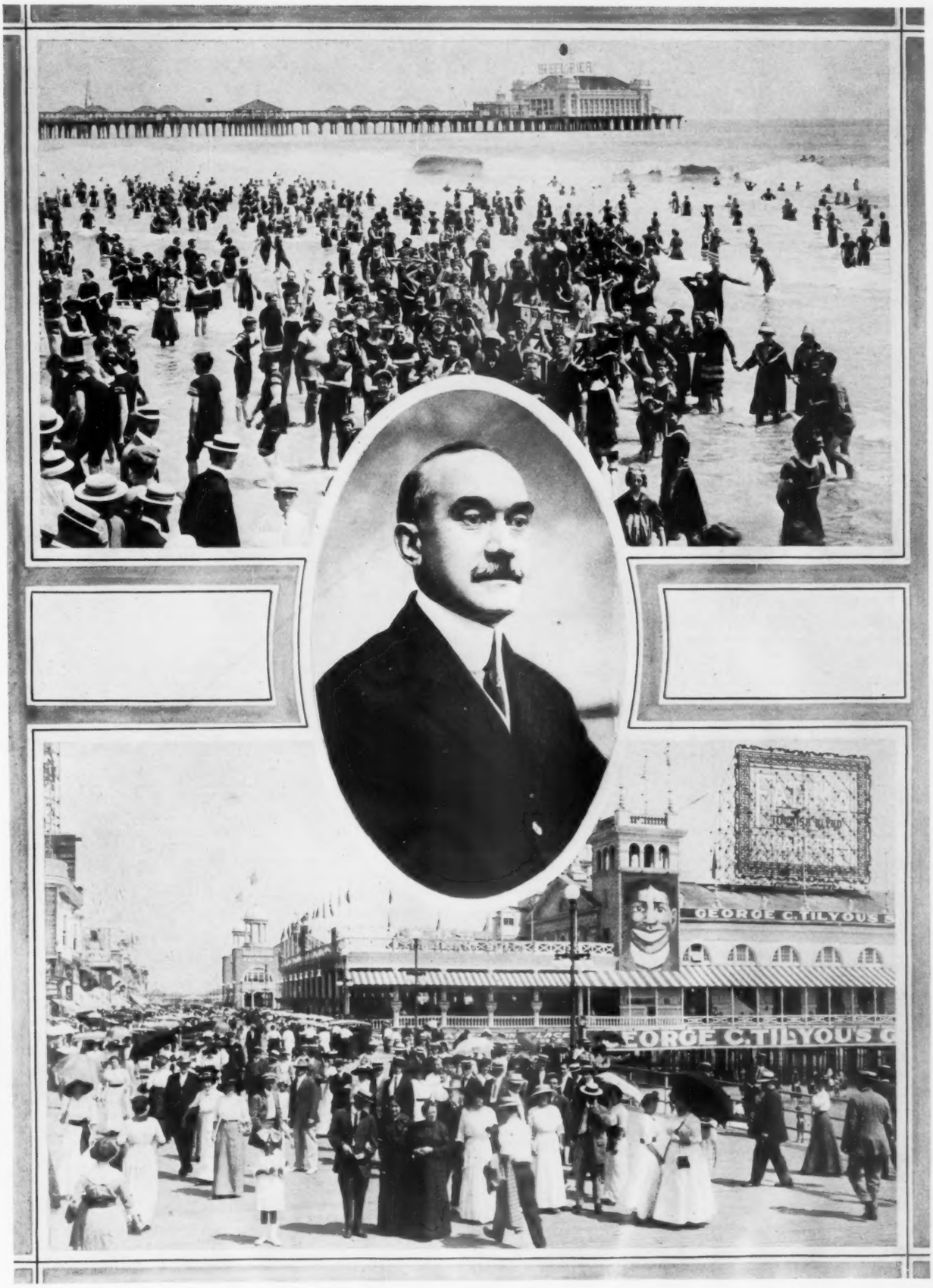
"The Failure of Structural Bronzes", by Dr. P. D. Merica, Bureau of Standards, Washington, D. C.

"Experiences with Brass in Civil Engineering Work", by A. D. Flinn, board of water supply, New York.

"Stellite", by Elwood Haynes, Haynes Stellite Works, Kokomo, Ind.

Thursday, Sept. 30, 7 p. m. Hotel Traymore

Annual banquet.



THE OCEAN, COOL AND INVIGORATING, ALWAYS BECKONS

G. H. CLAMER, PRESIDENT A. I. M.

ALWAYS YOU RETURN TO THE NEVER ENDING KALEIDOSCOPE OF THE BOARDWALK

trial territory immediately surrounding the famous Atlantic coast playground. Brief mention already has been made of some of the entertainment features. On Tuesday evening, Sept. 28, a theatre party will be provided for the members of the allied associations and the ladies registered at the convention. The ladies also are urged to attend the annual banquet Thursday evening. The diners will be addressed by John Kendrick Bangs, who is too well known to need any introduction, and by another speaker of equal prominence. Previous to the opening of the formal convention proceedings, on Monday evening an informal dance will be held on Young's pier. Music for dancing also will be provided on the pier throughout the exhibition period. Tickets for rides in the wheel chairs that are a prominent feature of the board walk, will be distributed to the ladies at the registration bureaus of the American Foundrymen's Association and the American Institute of Metals. Admission tickets to the Steeplechase pier and the Steel pier also will be distributed at the registration booths.

Visitors to the convention and exhibition will find Atlantic City unusually interesting. It has been called the world's premier pleasure and health resort. It is situated on an island 10 miles long and less than a mile wide, extending east and west, separated from the mainland by seven miles of salt streams and meadows. The city faces the south and the prevailing southwest breeze of late summer comes to it cooled by the ocean. A comparison of average temperatures only suggests the substantial difference between the summer temperature in Atlantic City and that which prevails at the great centers of population. Water on every side and continuous ocean breezes make impossible extremes found elsewhere. Atlantic City is a city of hotels, cottages, shops and amusement resorts. Its sole business is to give rest, health and pleasure to the people who come from all over the world. Every day of the year guests are accommodated with the comfort and elegance of the best metropolitan hotels and they also have at their disposal the most varied facilities for recreation and amusement. The leading hotels possess every modern convenience and luxury.

Visitors find that the most distinctive feature of Atlantic City is the famous board walk. It now extends eight miles along the beach with practically unobstructed ocean view. Its central portion is 60 feet wide and at no point is it less than 20 feet in width. It is a substantial structure erected from 10 to 50 feet above the sand upon massive pilings, at a cost of $500,000. It is brilliantly lighted every evening in the year.

Next to the ocean view and the promenaders, the rolling chairs are the prominent feature of the board walk. Extending seaward from the board walk are six great ocean piers, said to be the greatest series of piers devoted exclusively to recreation in all the world. The exposition and meetings of the American Foundrymen's Association will be held on one of the most prominent of these piers, as already pointed out. On the other piers will be given concerts by noted bands, dramatic entertainments, dances, and many other divertissements. Philadelphia with 121 casting plants ranks second among the foundry centers of the United States. The visitors at the convention and exhibition, therefore, will have an unusual opportunity to inspect plants and investigate the industrial conditions and methods in the large establishments of the east. A large number of important foundries have agreed to throw open their doors to the visitors. Among those who up to the time of going to press had agreed to extend the courtesies of their establishments to the delegates from the American Foundrymen's Association or the American Institute of Metals, are the following:

Southwark Foundry & Machine Co., Philadelphia.
American Engineering Co., Philadelphia.
Girard Iron Works, Philadelphia.
Sheeler-Hemsher Co., Philadelphia.
Eynon-Evans Mfg. Co., Philadelphia.
Baldwin Locomotive Works, Philadelphia.
J. W. Paxson Co., Philadelphia.
Tabor Mfg. Co., Philadelphia.
Isaac A. Shepherd & Co., Philadelphia.
R. D. Wood & Co., Philadelphia.
Wm. Sellers & Co., Inc., Philadelphia.
Ajax Metal Co., Philadelphia.
Thomas Devlin Mfg. Co., Philadelphia.
Niles-Bement-Pond Co., Philadelphia.
American Steel Foundries, Chester, Pa.
Seaboard Steel Casting Co., Chester, Pa.
Worth Bros. Co., Coatesville, Pa.
Baldt Steel Co., New Castle, Del.

The committee in charge of plant visitation, follows:

H. W. Brown, chairman, Tabor Mfg. Co., Philadelphia; Harry E. Asbury, Enterprise Mfg. Co., Philadelphia; W. J. Coane, Ajax Metal Co., Philadelphia; Geo. C. Davies, Pilling & Crane Co., Philadelphia; Harry Drinkhouse, Thos. Devlin Mfg. Co., Philadelphia; Thomas Evans, Eynon-Evans Mfg. Co., Philadelphia; Chas. H. Harrar, Midvale Steel Co., Philadelphia; J. S. Hibbs, J. W. Paxson Co., Philadelphia; Wilfred Lewis, Tabor Mfg. Co., Philadelphia; Geo. F. Pettinos, Pettinos Bros., Bethlehem, Pa.; Wm. H. Ridgway, Craig Ridgway & Son Co., Coatesville, Pa.; F. L. Shepherd, I. A. Shepherd Co., Philadelphia; A. G. Warren, J. W. Paxson Co., Philadelphia, and Robert Wetherill Jr., Robert Wetherill & Co., Chester, Pa.

For the Devotees of Golf

To afford the visiting foundrymen an opportunity to indulge in their favorite pastime of golf, special arrangements have been made with the Country Club of Atlantic City for the use of its course at Northfield, N. J. This feature is in charge of a special committee whose members will afford the golf devotees every assistance in indulging in their favorite sport. This committee is constituted as follows:

Condensed Program

Saturday, Sept. 25.

10:00 A. M.—Opening of the exhibition on Young's pier.

Monday, Sept. 27.

10:00 A. M.—Registration, Young's pier.
8:00 P. M.—Informal dance, Young's pier.

Tuesday, Sept. 28.

10:00 A. M.—Joint session, American Foundrymen's Association and American Institute of Metals.
2:00 P. M.—Professional session, American Institute of Metals, Hotel Traymore.
2:30 P. M.—Professional session, American Foundrymen's Association, Convention Hall, Young's pier.
8:00 P. M.—Theater party.

Wednesday, Sept. 29.

10:00 A. M.—Professional session, American Foundrymen's Association, Convention Hall, Young's pier.
10:00 A. M.—Professional session, American Institute of Metals, Hotel Traymore.
2:00 P. M.—Professional session, American Institute of Metals, Hotel Traymore.
2:30 P. M.—Professional session, American Foundrymen's Association, Young's pier.
8:00 P. M.—Annual business sessions, American Foundrymen's Association and the American Institute of Metals, Hotel Traymore.

Thursday, Sept. 30.

10:00 A. M.—Simultaneous professional sessions, American Foundrymen's Association for the discussion of steel and malleable casting practice, convention hall and annex, Young's pier.
10:00 A. M.—Professional session, American Institute of Metals, Hotel Traymore.
2:00 P. M.—Professional session, American Institute of Metals, Hotel Traymore.
2:30 P. M.—Simultaneous professional sessions, American Foundrymen's Association, for the discussion of steel and malleable practice, convention hall and annex, Young's pier.
8:00 P. M. — Annual banquet, Hotel Traymore.

Friday, Oct. 1.

Closing business session, American Foundrymen's Association, convention hall, Young's pier.
6:00 P. M.—Exhibition closes.

H. M. Bougher,. chairman, J. W Paxson Co., Philadelphia; Peter S. Brauscher, Philadelphia & Reading railroad, Reading, Pa.; W. J. Coane, Ajax Metal Co., Philadelphia; Wm. J. Devlin, Thomas Devlin Mfg. Co., Philadelphia; Howard Evans, J. W. Paxson Co., Philadelphia; Howard C. Matlack, Marshall, Matlack Co., Philadelphia; H. P. Rebman, American Engineering Co., Philadelphia; Otto Schaum, Schaum & Uhlinger Co., Philadelphia; J. H. Sheeler, Sheeler, Hemsher Co., Philadelphia; W. P. Smith, Wm. Cramp Ship & Engine Building Co., Philadelphia, and E. P. Williams, Baldwin Locomotive Works, Philadelphia.

The details of the special entertainment which will be provided for the ladies already have been given. In addition, a special ladies' committee has been appointed. The members of this committee are as follows:

Mrs. R. A. Bull, Granite City, Ill.; Mrs. G. H. Clamer, Philadelphia; Mrs. A. O. Backert, Cleveland; Mrs. W. M. Corse, Buffalo; Mrs. W. H. Bassett, Waterbury, Conn.; Mrs. Carrie Begley, So. Langhorne P. O., Pa.; Mrs. Howard M. Bougher, Philadelphia; Mrs. H. A. Carpenter, Providence, R. I.; Mrs. A. F. Corbin, New Britain, Conn.; Mrs. Alex T. Drysdale, Burlington, N. J.; Mrs. P. J. Flaherty, New Castle, Pa.; Mrs. C. E. Hoyt, Chicago, Ill.; Mrs. Alfred E. Howell, Nashville, Tenn.; Mrs. Walter T. MacDonald, Philadelphia; Mrs. Richard Moldenke, Watchung, N. J.; Mrs. L. W. Olsen, Mansfield, O.; Mrs. F. N. Perkins, Freeport, Ill.; Mrs. J. H. Sheeler, Germantown, Philadelphia; Mrs. E. M. Taggart, Philadelphia; Mrs. M. R. Taggart, Philadelphia, and Mrs. Arthur W. Walker, Watertown, Mass.

Local Convention Committee

The local convention committee, as mentioned at the beginning of this article, was recruited from six different states and includes the following:

Thomas Devlin, chairman, president Thomas Devlin Mfg. Co., Philadelphia; W. H. Bassett, vice president American Institute of Metals, American Brass Co., Waterbury, Conn.; Henry A. Carpenter, vice president American Foundrymen's Association, General Fire Extinguisher Co., Providence, R. I.; A. F. Corbin, president New England Foundrymen's Association, Union Mfg. Co., New Britain, Conn.; Alex T. Drysdale, vice president, American Foundrymen's Association, United States Cast Iron Pipe & Foundry Co., Burlington, N. J.; Stanley G. Flagg Jr., past president American Foundrymen's Association, Stanley G. Flagg & Co., Philadelphia; H. W. Gillett, vice president American Institute of Metals, Ithaca, N. Y.; Dr. Richard Moldenke, past secretary, American Foundrymen's Association, Watchung, N. J.; Geo. C. Stone, vice president American Institute of Metals, New Jersey Zinc Co., New York; A. W. Walker, past president, American Foundrymen's Association, Walker & Pratt Mfg. Co., Boston, and Walter Wood, vice president American Foundrymen's Association, R. D. Wood & Co., Philadelphia.

The Exhibitors and What They'll Exhibit

AJAX METAL CO., Philadelphia.—An extensive line of ingot metals will be displayed and a variety of castings made from these metals will be shown; represented by G. H. Clamer, W. J. Coane, Samuel K. McClure, H. L. Carpenter Jr., A. MacDougall, F. M. Willeson and C. F. Hopkins.

ARCADE MFG. CO., Freeport, Ill.—The extensive line of molding machines manufactured by this company will be shown in operation; this includes jolt-ramming machines, the modern molding machine, both hand and air operated; combination jolt and squeezing machines, hand squeezers, jolt-ramming, roll-over pattern-drawing machines; air squeezers, core jolters and other equipment will be displayed, including sand sifters and the Brillion pouring device.

ATKINS, E. C., & CO., Indianapolis.—An improved type of metal cutting hack saw will be displayed in operation, as well as a full line of saws for all purposes, including circular, band and friction disc. A non-breakable hack saw blade also will be exhibited; represented by Elmer A. Heidlinger.

AYER & LORD TIE CO., Chicago.—Creosoted wood blocks for foundry, machine shop and general industrial plant service will be displayed, showing various installations throughout the United States; represented by A. H. Noyes, W. H. Blythe, B. S. McConnell and E. L. Parvin.

BERKSHIRE MFG. CO., Cleveland.—An operating exhibit of molding machines will be made, which will include an automatic machine equipped with sand riddle and conveyor, air squeezer, core machine, universal molding machine, vibrators, etc.; represented by W. D. Fraser, F. Hulec and G. L. Cannon.

BESLY, CHARLES H., & CO., Chicago.—Surface grinders and grinding machinery.

BIRKENSTEIN, S., & SONS, Chicago.—Brass and bronze ingots, with a varied line of castings made from different alloys will be shown; represented by Lee Kahn, E. J. Schwab, J. W. Long and Harry Birkenstein.

BLYSTONE MFG. CO., Cambridge Springs. Pa.—A new, low charging, core sand and facing mixer equipped with a rotary screen will be shown. It is approximately 11¾ inches lower than the type of mixer built by this company in the past and the objectionable feature of height has been overcome by this type of construction; represented by Luther G. Conroe and H. J. LeFevre.

BROWN SPECIALTY MACHINERY CO., Chicago.—A working display will be made of a core machine with a maximum capacity for making round cores 3 inches in diameter, a core machine with a maximum capacity for making round cores 5 inches in diameter and another machine with a capacity for making round cores up to 7 inches in diameter. In addition, an electric and a pneumatic shaker and two sizes of a revolving barrel sand blast machine will be displayed; represented by H. P. Furlong, John Laycock, R. L. Laycock and E. A. Rich Jr.

BUCKEYE PRODUCTS CO., Cincinnati, O.—The foundry specialties and equipment manufactured by this company will be displayed; represented by C. J. Goehringer, B. Bernbaum, R. B. Ferguson, C. S. Weigert and J. B. Carpenter.

BUCH FOUNDRY EQUIPMENT CO., Bridgeport, Montgomery Co., Pa.—An operating exhibit of molding equipment will be made, consisting of a hand jar-ram, squeezer, roll-over and pattern-drawing machine, as well as an electrically-operated jar-ramming, squeezer, roll-over and pattern-drawing machine; represented by R. S. Buch, J. E. Buch, G. E. Bates and J. L. Nute.

CARBORUNDUM CO., Niagara Falls, N. Y.—A complete line of carborundum and aloxite wheels for grinding cast iron, brass, bronze, aluminum, steel and malleable castings will be displayed. Metallic silicon, carborundum fire sand and carborundum paper and cloth also will be exhibited; represented by George R. Rayner.

CATARACT REFINING & MFG. CO., Buffalo.—Samples of foundry core oil and parting, cores made by the use of these core oils as a binder and also specimens of machine work made with cutting compounds and cutting oils furnished by this company will be displayed; represented by H. C. Hutchins, R. J. Collins, F. E. Hill, J. Purvis, A. A. Schaefer, J. E. Chism, F. M. Edwards and L. S. Smith.

CLARK, CHARLES J., Chicago.—A blast meter which is a gage for measuring the volume of blast supplied to cupola and malleable furnaces, will be shown. A working demonstration of the meter will be made and meters of various capacities will be displayed; represented by Charles J. Clark.

CLARK FOUNDRY CO., Rumford, Me.—A combined punch and shear will be shown; represented by F. B. Clark and S. J. Gonya.

CLARK, GEORGE P., & CO., Windsor Locks, Conn.

CLEARFIELD MACHINE SHOPS, Clearfield, Pa.—A model of a 50,000-pound, 8-foot wet pan used for mixing and tempering foundry sand, core sand, etc., will be displayed. In addition to showing the features of its construction, the model will run on actual material to illustrate the method of operation; represented by F. B. Reed and P. B. Reed.

CLEVELAND AUTOMATIC MACHINE CO., Cleveland.—A motor-driven, 2½-inch full automatic machine will be shown in operation. A great variety of speeds in both directions is obtainable from the motor-drive and the speed increases and decreases when the tools are cut on the various diameters as the operations take place; represented by J. P. Brophy.

CLEVELAND PNEUMATIC TOOL CO., Cleveland.—This exhibit will consist of a complete line of air tools, including riveting and chipping hammers, all sizes of air drills, valve, emery, bench and center grinders, corner and compound drills, five sizes of rammers, air hose couplings, etc.; represented by H. S. Covey, A. Scott, J. A. Day, G. Gregory and F. E. Schwarze.

CLIPPER BELT LACER CO., Grand Rapids, Mich.—Belt lacers and belt hooks will be shown. The belt lacer is a small, portable tool in which are inserted a row of belt hoops. The squared end of the belt to be laced then is inserted and by depressing the handles, the hooks are deeply imbedded

into the end of the belt, leaving a uniform row of hooks extending across the belt end. When the other end is silmarly treated, the two ends are brought together around the face of the lower pulley in such a way as to intermesh the loops. A rawhide pin is slipped through these intermeshed loops and the job is finished; represented by William F. Kall and J. R. Yost.

DIXON, JOSEPH, CRUCIBLE CO., Jersey City, N. J.—All kinds of graphite products, including crucibles, stirrers, etc., for brass foundry use will be displayed; represented by Frank Krug.

FELT & TARRANT MFG. CO., Chicago.—Demonstration will be made of an adding and calculating machine.

FOUNDRY, THE, Cleveland. — A large booth will be fitted up as an office and rest room for the use of visiting foundrymen; represented by John A. Penton, A. O. Backert, J. D. Pease, H. Cole Estep, E. C. Kreutzberg, A. W. Howland, G. O. Hays, L. C. Pelott and S. H. Jasper.

GARDNER MACHINE CO., Beloit, Wis.—A complete line of grinding machines and accessories will be displayed.

GENERAL ELECTRIC CO., Schenectady, N. Y.—Arc welding equipment will be shown in operation, as well as a centrifugal compressor for furnishing blast for cupola operations.

GOLDSCHMIDT THERMIT CO., New York.—A complete line of heating thermit cans for reviving dull iron in the ladle, making semi-steel, keeping risers liquid, etc., and titanium thermit cans for purifying molten iron and steel and increasing fluidity will be displayed. A comprehensive exhibit also will be made of the extensive line of alloys made by this company for foundry use. This includes ferro-vanadium, ferro-titanium, cupro-vanadium, manganese, chromium, cobalt, manganese-copper, manganese-titanium, phosphor-copper and manganese-aluminum. Specimen thermit welds on heavy sections will be shown, one of the most important of which will be a weld on a 9¼-inch crankshaft. A display also will be made of welding pipe joints by the thermit process; represented by H. G. Silsbury, D. B. Browne, William Aldrich, H. D. Kelley and J. G. McCarty.

GRACETON COKE CO., Graceton, Indiana Co., Pa.—Foundry coke manufactured by this company will be exhibited; represented by C. M. Lingle, W. F. Gates, T. M. Doherty and M. F. Brandon.

GREAT WESTERN MFG. CO., Leavenworth, Kas.—Several gyratory foundry riddles of new type, together with portable supports for these machines, will be shown in operation; represented by G. W. Combs and F. A. Pickett.

HARDY, F. A., & CO., New York.—A complete line of safety glasses and eye protectors for use in foundries and machine shops will be shown. Also, goggles for welders and melters equipped with special lenses will be exhibited; represented by W. B. Gosman.

HAYWARD CO., New York.—An electric motor clam shell bucket suspended from a hoist, as well as a midget derrick outfit will be exhibited. Numerous other buckets for foundry use and other industrial purposes also will be displayed; represented by H. M. Davison, H. S. Atkinson and C. F. Hutchings.

HERMAN PNEUMATIC MACHINE CO., Zelienople, Pa.—The line of molding machines manufactured by this company will be operated and the exhibit will include an independent turn-over and pattern-drawing device. This machine jars the mold, draws the pattern and finishes the mold complete to receive the cores. It is employed successfully on tunnel segments, bolsters, boiler sections, etc. A combination jar-ramming, squeezer and stripping plate machine will be exhibited as a plain squeezing machine and as a combination jar-ramming, squeezing and stripping plate machine. In the demonstration of this machine snap flask work will be mounted with the use of split patterns, also match plate and stripping plate work. Both copes and drags will be made in one operation on a portable jar-ramming, stripping plate machine. In addition, small plain jar-ramming machines and core-making machines, demonstrating the application of the jar-ramming principle to the production of cores, will be exhibited; represented by A. M. Frauenheim, Alfred Herman, Thomas Kaveny, M. L. Heyl, R. F. Ringle, A. Rodgers, Alfred McWithey and Joseph Larson.

HEROLD BROS. CO., Cleveland.—Various types of brushes employed in foundry and machine shop operation, including the "Electra Weld" wire wheel brush manufactured by this company, will be displayed. A line of molders' brushes also will be shown.

HILL & GRIFFITH CO., Cincinnati, O.—No display of the extensive line of foundry supplies manufactured by this company will be made, but a booth will be fitted up attractively where the representatives of the Hill & Griffith Co. can meet their friends; represented by William Oberhelman, J. M. Glass, James A. Carey and F. McCarthy.

INGERSOLL-RAND CO., New York City.—A complete line of pneumatic tools will be displayed, including drills in a wide range of sizes and types for drilling, reaming, tapping, flue rolling and other similar work and chipping, scaling and caulking hammers for general foundry service. Riveters will be displayed equipped both with and without safety rivet set retainers, in both outside and inside trigger patterns. A feature will be made of a grinder, as well as a close quarter drill. Both bench and floor type sand rammers will be shown, as well as air motor hoists in capacities from one-half to five tons. In addition, the Ingersoll-Rand Co. is furnishing two compressors for supplying air for the various exhibits. One of these machines is an Imperial, short belt, electric motor-driven unit of the duplex type and the other is an Ingersoll-Rogler straight line steam-driven machine. Both compressors are wholly enclosed, dirt and dust-proof, and are automatically lubricated; represented by George A. Gallinger, F. K. Armstrong, George S. Johnston, L. W. Schnitzer and Walter A. Johnston.

INTERNATIONAL MOLDING MACHINE CO., Chicago.—An extensive line of molding equipment will be exhibited, including turn-over draw, jar-ramming, core-making and combination molding machines of several different styles, as well as power and hand squeezers; represented by Edward A. Pridmore, W. W. Miller, J. W. Dopp and F. W. Hamel.

INTERNATIONAL STEAM PUMP CO., New York.—Sand riddlers, core wire straighteners and an air compressor will be shown in operation. The sand riddlers are either air, steam or electrically-driven and are built in any type to meet the particular conditions to be met. The steam or air type of the large machine is provided with an improved cushioning device fitted to the cylinder, which insures the minimum vibration of the supporting frame and at the same time imparts the right motion to the reciprocating screen with a minimum power consumption. In the motor-driven machine the reciprocating rod is driven through reduction gears from the motor. The core wire straightener is designed to reclaim the bent wire used in strengthening foundry cores. It can be arranged for either belt or electric drive. The compressed air for other exhibitors will be furnished by a Laidlaw motor-driven feather valve air compressor furnished by the International company. The frames are completely enclosed, thereby protecting the working parts from the foundry dust and grit. The lubrication is automatic, the connecting rod and crosshead bearings running in oil.

IRON TRADE REVIEW, THE, Cleveland.—A large booth will be fitted up as an office and rest room for the use of visiting foundrymen; represented by John A. Penton, A. O. Backert, J. D. Pease, H. Cole Estep, E. C. Kreutzberg, A. W. Howland, G. O. Hays, L. C. Pelott and S. H. Jasper.

JENNISON-WRIGHT CO., Toledo.—Sections of creosoted wood block floors for machine shops, foundries, loading platforms, wharves, piers, etc., will be shown. Photographs also will be displayed of various installations; represented by H. G. Jennison, L. P. Drinker, F. E. Jennison, Isaac Wright and Frank B. Goodman.

KING, JULIUS, OPTICAL CO., New York City.—A full line of goggles for use by foundry employes in chipping, cleaning and other hazardous operations will be shown. In addition, arc welders helmets, babbitting masks, welders goggles, etc., will be displayed. A special machine for testing lenses for goggles will be operated, as well as a device which will demonstrate the proper color of lenses for goggles to be used by welders, melters, etc.; represented by Walter G. King and F. W. King.

LANDIS TOOL CO., Waynesboro, Pa.—A 12 x 36-inch grinding machine will be shown in operation; represented by T. H. King.

LEHIGH COKE CO., South Bethlehem, Pa.—Photographs of various departments of the company's plant will be displayed, showing in detail the manufacture of by-product coke, as well as a graphic representation of the by-products obtained in the manufacture of this fuel, such as sulphate of ammonia, tar, gas, benzol, toluol, xylol, solvent naphtha, etc.; represented by D. A. Barkley.

LINCOLN ELECTRIC CO., Cleveland.—Several arc welding outfits will be shown in operation repairing castings and cutting-off risers and heads; represented by Robert E. Kinkead.

LUPTON'S, DAVID, SONS CO., Philadelphia.—A complete line of products for lighting and ventilating, with particular reference to lighting and ventilating foundry buildings, will be displayed. Various types of steel sash, skylights, operating device, etc., will be exhibited, as well as photographs of a large number of foundries and other buildings in which Lupton products have been used. The Pond truss roof formation, designed especially for use in foundries and forge shops, also will be shown; represented by Clarke P. Pond and C. F. P. Buckwalter.

MACLEOD CO., Cincinnati.—In this exhibit will be displayed a sand blast machine, blacking swab sprayer, portable oil burners and an oxy-acetylene welding and cutting torch; represented by W. F. Stodder.

MALLEABLE IRON FITTINGS CO., Branford, Conn.—A complete line of hardened steel vibrators, ranging in size from ⅜ to 2 inches piston diameter, will be displayed. All parts of these vibrators are hardened and ground, the cylinders lapped and great accuracy is maintained throughout. Practical demonstrations of the operation of these vibrators will be made; represented by G. B. Pickop.

McCORMICK, J. S., CO., Pittsburgh.—An extensive line of foundry supplies will be exhibited, including Lik-Kor binder, and a Blystone sand mixer also will be shown; represented by J. S. McCormick, T. E. Malone and E. R. Costley.

MIDLAND MACHINE CO., Detroit.—A light 6-inch jolt-ramming roll-over molding machine will be shown in operation which has a lifting capacity of 1,000 pounds and will handle flasks up to 32 x 42 inches with a 12-inch pattern draw. Other equipment to be exhibited will consist of a hand roll-over machine, small coremaking machine and a pneumatic riddle with a special device; represented by George L. Grimes and C. J. Skeffington.

MONARCH ENGINEERING & MFG. CO., Baltimore. — The extensive line of crucible metal melting and refining furnaces, as well as the heating furnaces manufactured by this company will be exhibited; represented by H. D. Harvey.

MOTT SAND BLAST MFG. CO., New York.—A new type of sand blast barrel will be shown in operation, as well as a hose-type machine and a cabinet for matting or imparting a velvety finish to softer metals and a rotary compressor for pressures up to 15 pounds. A general line of sand blast apparatus and accessories also will be displayed; represented by David Mayer, E. J. Rosenthal, F. F. Hull, George Fletcher and Edward Keis.

MUMFORD, E. H., CO., Elizabeth, N. J.—The various types of molding machines to be displayed by this company will be shown in operation; these include plain jolt-ramming machines, pit pattern-drawing mechanism, split pattern machines, plain power squeezers, combination jolt, squeeze, ramming, split pattern machines and combination jolt squeezer machines.

MUMFORD MOLDING MACHINE CO., Chicago.—A new type of molding machine will be shown in operation and a working model will be displayed demonstrating the working parts of the jar-ramming machine built by this company; represented by J. T. Lee, A. F. Jensen and D. M. Whyte.

NATIONAL ENGINEERING CO., Chicago.—A core sand and facing mixer will be shown in operation. It is claimed that it will mix core sand with less binder than ordinarily required as a result of the thorough mixing of the binder with the sand. For the same reason it is claimed that it will mix facing sand with less coal dust than ordinarily is required. This mixer also can be utilized for reclaiming gangway waste, or sand from old cores shaken-out of castings. This is accomplished by adding a small amount of new molding sand to the old sand and by thoroughly incorporating the new sand grains with the old, a homogeneous mixture is obtained. It is claimed that by the use of this machine one man can mix all of the facing and core sand required in a jobbing foundry employing 40 to 50 molders; represented by P. L. Simpson.

NEW HAVEN SAND BLAST CO., New Haven, Conn.—A sand blast rolling barrel will be exhibited, as well as an automatic hose-type machine controlled entirely by opening and closing an air valve and a sand blast barrel designed particularly for cleaning large work; represented by C. E. Billings and C. S. Johnson.

NORMA CO. OF AMERICA, New York.—A complete line of precision ball, roller, thrust and combination bearings will be displayed. Not only will the product be shown, but ample opportunity will be afforded for the consideration of the mounting of the bearings and the assembling of parts into machines as a whole; represented by John T. R. Bell, E. A. Perkins, G. R. Bott and O. P. Wilson.

NORTON CO., Worcester, Mass.—Various types of bench and floor grinding machines equipped with hoods will be displayed and some of this equipment will be operated. The machines that will be exhibited will consist of two 1¼-inch bench machines equipped with hoods of different types and a 1¾-inch floor stand equipped with a hood of the closed type. In addition, grinding wheels, particularly those of the coarse type used in foundry work, will be shown; represented by R. G. Williams, Carl F. Dietz, S. A. Craig, Oscar E. Nordstrom and George S. Welker.

OBERMAYER, S., CO., Chicago.—A booth will be fitted up for the reception of the friends and customers of this company; represented by S. T. Johnston, E. D. Frohman, C. M. Goldman, F. H. Dodge, W. H. Fitzpatrick and J. J. McDevitt.

OSBORN MFG. CO., Cleveland.—The extensive line of molding machines manufactured by this company will be shown in operation. A distinctive feature of this exhibit will be a 42-inch jar-ramming molding machine which will be electrically-driven and a new type of roll-over machine. In addition, a display will be made of several types of squeezers, including the split pattern, jolt and plain squeezer with sand straddle base, jolt-ramming machine for making cores, small roll-over machine, roll-over hand jolt, roll-over rock-down and roll-over drop draft machines; represented by H. R. Atwater, E. W. Jacobi, E. T. Doddridge, M. W. Zeeman, J. H. Galloway, E. S. Carman, Paul Ryan, F. G. Smith and F. D. Atwood.

OXWELD ACETYLENE CO., Chicago.—Oxweld cutting and welding equipment, blowpipes, regulators and accessories will be shown and a working demonstration will be made of welding iron and steel castings and other metals and cutting steel risers and billets; represented by W. S. Hoyt, R. R. Browning, C. K. Bryce, L. E. Ogden and P. A. Mauerhoff.

PANGBORN CORPORATION, Hagerstown, Md.—Various types of sand blast machines and allied equipment will be shown in operation. Castings of all kinds will be sand-blasted throughout the week, which will include castings made from metal melted in the Snyder electric furnace.

PAXSON, J. W., CO., Philadelphia.—This exhibit will specialize on sand blast cleaning equipment and a horizontal sand blast tumbling barrel with oscillating nozzles will be shown. In addition, a line of molding sands and foundry facings will be displayed and an exhibit will be made of blue prints and photographs of sand blast plants, sand blast machines, sand separators, suction and bucket elevators, sand and dust collectors, elevating equipment, sand blast cabinet and an oblique sand blast tumbling barrel combined with cabinet. A further display of photographs will be made containing approximately 500 views of foundry equipment, supplies, sand banks, clay pits, Paxson boats and the company's foundry, machine and forge shop; represented by Howard M. Bougher, Edward M. Taggart, Joseph S. Hibbs, James B. Ellis, I. F. Kremer and Francis J. Zippler.

PICKANDS, BROWN & CO., Chicago.—An artistic display of Solvay coke will be made in the form of a liberty bell. It will be a replica of the original, about 12 feet high. The display will bear the following slogan: "Liberty Bell and Solvay Coke—Messengers of Freedom"; represented by J. A. Galligan.

PRIDMORE, HENRY E., Chicago.—The extensive line of molding machines manufactured by this company will be shown in operation, including stripping plate, hand rock-over drop, power rock-over drop, squeezer, plain electric and combination jarring machines. Several of these machines recently have been greatly improved and these new features will be demonstrated; represented by Mrs. E. M. Pridmore, Harry Pridmore, D. F. Eagan, C. H. Ellis and A. V. Magnuson.

READY TOOL CO., Bridgeport, Conn.—Lathe tools, machine dogs and boring bars will be displayed, as well as a "Safety First" belt stick and laminated Stellite tools in several designs. Heavy roughing tools for both rifle barrel and shrapnel work also will be displayed; represented by Thomas and Harold Fish.

RICHEY, BROWNE & DONALD, Maspeth, New York.—A roller-ramming molding machine with sand-handling appliance will be shown in operation. The roller-rammer eliminates hand-ramming entirely and prevents the necessity for tucking and venting. The roller is operated on a broken-link rack bar, which enters a pit at the base of the machine. Its adjustable sides are constructed to permit the use of patterns of varying widths while maintaining a stripping edge and securing absolute rigidity of the pattern. The drawing plate and pattern are supported by two air springs, thereby balancing the weight and making the operation easy, while the mechanism is so adjusted that the patterns can be drawn in perfect alignment. A standard vibrator is employed and the working parts of the machine are enclosed. The sand-handling appliance consists of a large sand shovel which handles in one operation all the sand required to make one mold, thereby eliminating hand shoveling. In addition, it is equipped with a sand breaker and mixer, which removes the sand from the flasks after the castings have been made; represented by Walter H. Hofmann and E. Foster Babbitt.

ROBESON PROCESS CO., New York.—The exhibit space of this company will be fitted up as a rest room for visiting foundrymen. Samples of glutrin will be displayed; represented by G. N. Moore, T. J. Tyan and R. S. Hughes.

ROGERS, BROWN & CO., Cincinnati.—Moving pictures entitled "From Mine to Molder", depicting the various processes of iron manufacture from the mining of the ore to the pouring of the castings, will form the principle feature of this company's exhibit. A daily display of these pictures will be made at 2:30 p. m.; represented by A. A. Fowler, F. W. Bauer, T. A. Wilson, A. O. Sonne, Cecil Bertie, George R. Sullivan, F. J. Waldo, H. W. Fernald, Otto Arlt, R. W. Clark, J. C. Claussen and Standish Meacham.

SAND MIXING MACHINE CO., New York.—A machine for cutting and preparing molding sand will be operated. It is driven electrically and is built in several sizes from 4 feet 8 inches to 7 feet. It has a capacity for cutting about 10 heaps per hour and is operated preferably at night, only one man being required. The machine also can be employed successfully for mixing core and facing sand; represented by V. E. Minnich.

SLY, W. W., MFG. CO., Cleveland.—A sand blast barrel will be shown in operation and a display will be made of photographs depicting the extensive line of cleaning room equipment manufactured by this company; represented by George J. Fanner, P. W. Graue and Alfred Anderson.

SMITH, R. P., & SONS CO., Chicago.—Safety congress shoes for molders will be exhibited; represented by J. B. Smith Jr.

SNYDER ELECTRIC FURNACE CO., Chicago.—One of the features of the exhibition will be the operation of a Snyder electric furnace, which will melt cold scrap and will pour heats three times daily, namely at 11 a. m., 2 and 5 p. m. The finished castings will be cleaned by sand blast machines operated in adjoining booths and a part of each day's output will be machined by some of the machine tools that will be displayed. Tests

will be made at Philadelphia of the castings from each heat and the results will be announced the following day. Each heat will be taken off under the direction of a foundryman, which will greatly add to the practical and commercial aspect of the undertaking. The furnace, which will be operated on a basic bottom, will be of the one-ton type with a capacity of 10 tons of steel in 24 hours; represented by Carl H. Booth, F. J. Ryan and W. D. Walker.

STANDARD SAND & MACHINE CO., Cleveland.—A batch mixer will be shown in operation and a large batch mixer and a core pulverizing machine also will be displayed; represented by Harry E. and H. G. Boughton.

STERLING WHEELBARROW CO., West Allis, Wis.—Seven new styles of rolled steel foundry flasks will be exhibited for the first time, which are made of special rolled flask material, but will be differently equipped than flasks exhibited heretofore. These new styles have been in use for some time and have found favor with foundrymen generally. In addition, wheelbarrows, wedges, skim gates, snap flasks, etc., will be displayed; represented by I. R. Smith, E. W. Sample, E. W. Dowd, George L. Lambkin and H. A. White.

STODDER, W. F., Syracuse, N. Y.—A suction sand blast nozzle will be displayed, as well as photographs of the Broughton core sand mixer; represented by W. F. Stodder, W. J. Van Zandt and M. A. Stodder.

STRONG-KENNARD & NUTT CO., Cleveland.—A complete line of protection glasses for chippers, grinders, welders and other industrial operatives will be displayed. A feature will be made of a testing device to test the strength and efficiency of the goggles that will be shown. Another device will be operated which will show the value of colored glasses for welders; represented by B. W. Nutt.

STUART AMERICAN PRODUCTS CO., Memphis, Tenn.—A burner will be exhibited for burning fuel oil.

TABOR MFG. CO., Philadelphia.—All of the molding machine equipment to be displayed will be shown in operation. Various types of machines that will be exhibited include shockless jarring, combination shockless jarring, roll-over and pattern-drawing, both stationary and portable types; stationary and portable plain power squeezers, jarring squeezers, plain jarring, shockless jarring, hand-ramming roll-over and combination shockless jarring and squeezing. In addition, an exhibit will be made of the Taylor-Newbold inserted tooth cold saw applied to a Newton cold saw cutting-off machine, which will be operated cutting off bar stock; represented by Wilfred Lewis, H. K. Hathaway, H. W. Brown, J. T. Ramsden, J. H. Coleman, H. W. Impey, D. J. Martin and Jacob Degler.

THOMAS IRON CO., Easton, Pa.—Full-size pigs of sand cast "Thomas-Vanadium" pig iron will be shown, as well as specimen castings made from mixtures of which this iron forms the greater part. Full-page advertisements published during the past year in *The Iron Trade Review* and in THE FOUNDRY, suitably framed, also will be on display; represented by Philip E. Wright, Willard Wright and E. Arthur Tutein.

TITANIUM ALLOY MFG. CO., Niagara Falls, N. Y.—Samples of titanium-treated iron and steel, brass and bronze castings will be shown, as well as a special line of titanium aluminum bronze castings; represented by N. Petinot, R. T. Harris, A. C. Hawley, W. M. Corse, H. R. Corse and C. Vickers.

UNION STEAM PUMP CO., Battle Creek, Mich.—This operating exhibit will consist of several enclosed type, belt and steam-driven horizontal compressors and several sizes of vertical duplex and single cylinder compressors. This equipment will be so arranged that the movement of a good many of the inside parts can be observed when the machines are running. Several steam and power pumps also will be operated; represented by C. A. Stuck and K. D. Smith.

UNITED STATES GRAPHITE CO., Saginaw, Mich.—Graphite products for foundry use.

WATERBURY WELDING CO., Waterbury, Conn.—Foundry riddles.

WESTINGHOUSE ELECTRIC & MFG. CO., East Pittsburgh, Pa.—A 500-ampere, 60-horsepower arc-welding set will be shown in operation. The operator will perform welding operations on various castings and a number of examples of difficult jobs welded by this equipment will be displayed; represented by R. F. Moon, H. C. Stier, W. H. Patterson, J. H. Bryan and H. W. Beaumont.

WHITE & BRO., Philadelphia.—Samples of various grades of ingot metals will be shown, as well as a variety of castings made from these metal mixtures; represented by John T. Fegley, Raymond Hunter, George W. Proctor, Howard M. Rennie, G. Wilbur Nixon and J. D. K. McLees.

WHITING FOUNDRY EQUIPMENT CO., Harvey, Ill.—A pictorial display will be made of the extensive line of foundry equipment manufactured by this company, together with numerous views of foundry installations; represented by C. A. Hardy and R. H. Bourne.

WILLSON, T. A., & CO., Inc., Reading, Pa.—A display will be made of safety glasses and eye protectors for all industrial requirements. A goggle especially designed for grinders, machinists and operatives engaged in light work will be shown; represented by H. W. Davie and Gordon D. Richardson.

WOOD, T. B., SONS CO., Chambersburg, Pa.—The Wood system of tapering snap flask molding, comprising taper snap flask and automatic adjustable snap jackets, will be demonstrated. The use of this flask will be shown in connection with molding machines, as well as bench and floor work. The adaptability of the snap jacket to both straight and tapered side molds will be demonstrated and specimens of castings made with this equipment will be exhibited; represented by Charles O. Wood, George M. Naylor and Victor Lesher.

WOODISON, E. J., CO., Detroit.—This exhibit will consist of automobile cylinders, in the making of which a liquid core binder was used for making the cores; represented by E. J. Woodison, George A. Burman and P. G. Smith.

WYOMING SHOVEL WORKS, Wyoming, Pa.—This exhibit will consist of all styles and patterns of shovels, particularly those adapted for foundry use.

Molybdenum and Copper

By C Vickers

MOLYBDENUM is a metal little known in brass founding and there is reason to believe that it will not find extensive application in non-ferrous alloys in the future owing to its refractory nature, which makes it impossible to introduce it into brass or bronze unless some means are discovered of alloying it with copper. This seems to be difficult of accomplishment and the tests which will be outlined would indicate that molybdenum and copper do not alloy in any proportion.

When these experiments were begun, the molybdenum was added to the molten copper, the latter having been melted in a coke-fired furnace. The copper was melted without a charcoal cover so that the surface of the metal would be quite clear to permit of observing the action of the molybdenum when added. The refractory property of this metal was known, but it was believed that possibly it might be dissolved by the copper at a high temperature. The molybdenum addition amounted to 4 per cent, the metal having been added to the copper in granular form. The molybdenum was heated rapidly to incandescence on the surface of the copper, but it did not dissolve, although the copper was strongly heated for about one hour. When the molybdenum was added, the copper was in a state of ebullition and at the conclusion of the test practically all of the molybdenum was recovered.

Considering the fact that the copper was melted without charcoal and that it was held at so high a temperature for a considerable period, the sand castings which were poured were not nearly so porous as might have been expected under these conditions. The recovered molybdenum was vitrified externally so that it is probable that a small amount was dissolved and acted as a deoxidizer, although this metal is not particularly active in this respect.

In a second trial in the crucible furnace, 0.5 per cent of metallic molybdenum was added to the copper with the cold charge and this was melted at the highest temperature that could be attained in this type of furnace. The resulting castings were porous and the pouring head swelled, although not to any great extent. The copper did not appear to be as badly oxidized as would have been the case when the molybdenum had been omitted and this test, the same as the first

(*Continued on Page* 353)

How Sewing Machine Parts are Molded and Cast

The Molding Machine Plays an Important Part in the Production of These Light Castings at the Plant of the King Sewing Machine Co.

By H Cole Estep

AMONG THE several great, revolutionary inventions of the early nineteenth century that of the sewing machine was by no means the least important. Scarcely any other mechanical contrivance has had so far-reaching an effect on both our commercial and domestic activities. Furthermore, the two great men who were most vitally connected with its early development, Elias Howe and Isaac M. Singer, did their work so thoroughly that the fundamental principles of sewing machine design and construction became permanently fixed before their deaths. With the passage of years, however, many important details have been refined and simplified and the scope and capacity of the machines have become greatly augmented. In addition, the past two decades have witnessed tremendous changes in the methods of manufacture, with the result that the modern sewing machine factory is entirely different from its predecessor of 25 years ago. On account of this evolution, the demands on the foundry end of the business have become increasingly exacting. The modern sewing machine is sold at prices much lower than those prevailing a generation ago and the industry has been reduced to a highly standardized and keenly competitive basis, making it necessary to shave costs wherever possible. The foundry, therefore, is called upon to furnish castings which can be turned into finished parts at minimum expense. Continuously satisfactory results cannot be expected from automatic machine tools unless the castings are uniform both with respect to dimensions and hardness. Also, many hours can be saved in the machine shop by cutting down the amount of metal to be removed. It has been estimated that the average weight of typical sewing machine castings has been reduced 10 per cent in the last few years, simply by the elimination of unnecessary metal, resulting from the general adoption of machine molding, and by reductions in the thickness of the sections where strength is not a prime requisite.

In modern sewing machine foundries, therefore, we find the methods of production refined to an unusual degree. One of the most typical plants of this character is that operated by the King Sewing Machine Co., Buffalo, N. Y. The King shop is said to be one of the first in the country to employ molding machines and at the present time all of the important sewing machine parts are machine-molded. For several of the more difficult operations swing-head air squeezers are employed. In addition, plain squeezers and ordinary rock-over drop machines are utilized. Some of the smaller parts are at present molded in snap flasks at the bench. In addition to the molding, special attention has been given to the facilities for mixing, melting and handling

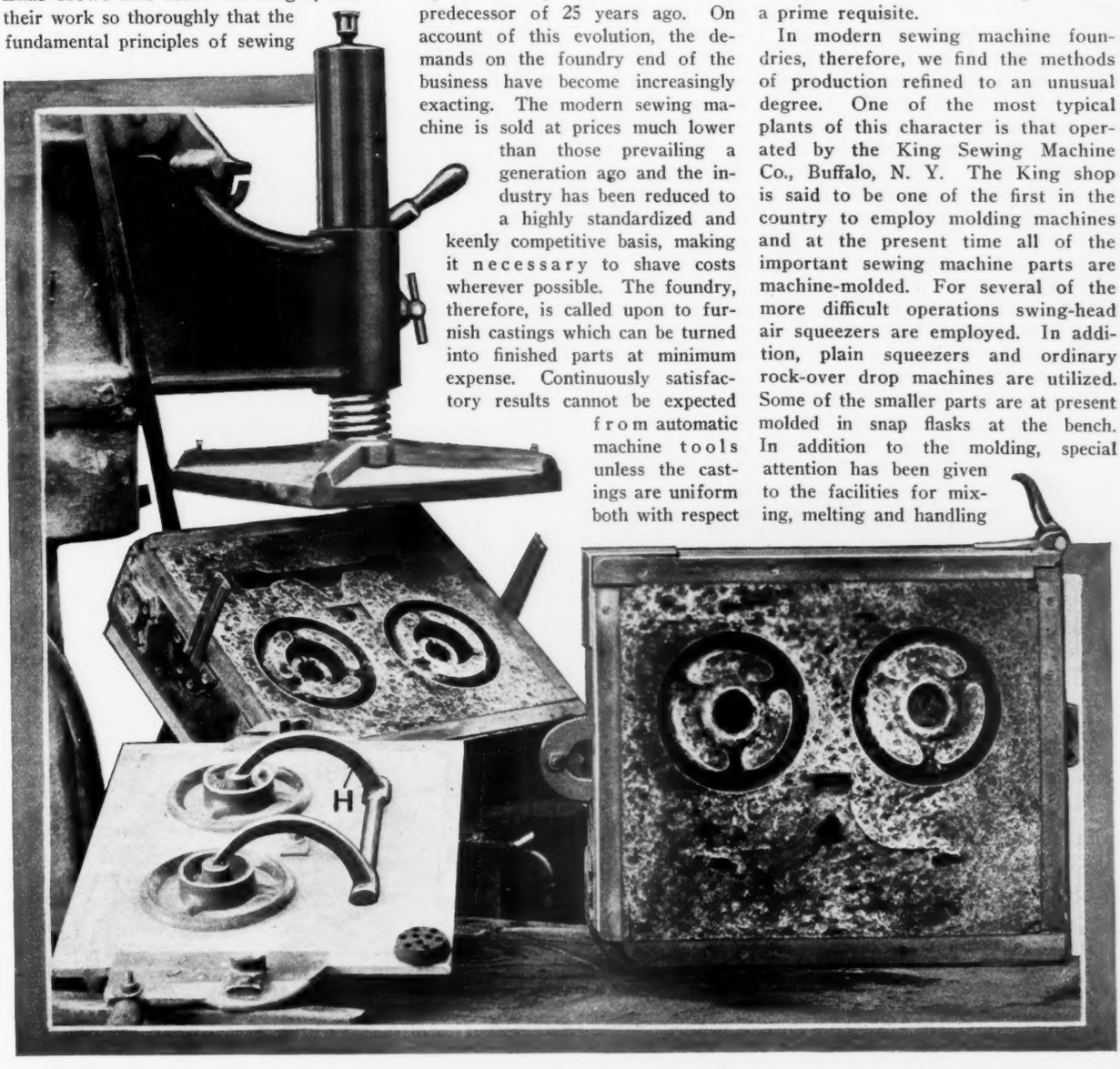


FIG. 1—THE BALANCE WHEELS ARE MOLDED ON A SWING HEAD SQUEEZER USING A MATCH PLATE PROVIDED WITH A HORN GATE

the iron and in this connection a special pouring device has been developed. The core room has received its full quota of attention and for many symmetrical parts, such as the arm, special cast iron core boxes, provided with brass separators, are employed. These boxes, which are used in connection with special cast iron core driers, permit the whole core to be made at one time, subsequent pasting operations being eliminated. The cleaning room methods also are interesting, special apparatus being employed to produce the high finish required on sewing machine castings.

The King Sewing Machine Co.'s foundry is in charge of F. G. Stewart, foundry superintendent. Mr. Stewart designed several of the molding machines employed in the shop, together with the pouring device, considerable of the core room apparatus and other auxiliary appliances.

Not including certain small bushings, etc., the gray iron foundry is called upon to furnish 15 parts for each King sewing machine. These parts are as follows: Treadle, treadle rod, bed, balance wheel, arms, legs, bobbin winder frame, guard, shuttle bell crank, worm wheel guard, back brace, ball casing, feed rocker shaft, arm rocker shaft and feed fork connection. It is the purpose of this article to cover the molding and casting of several of the most important of these parts.

The arm is molded on a special swing-head air squeezer machine that was designed by Mr. Stewart. The general construction of this machine is shown clearly in Fig. 2. The air cylinder, which is of ample dimensions, is bolted to a heavy cast iron bed plate, which is provided with lugs for carrying the four wheels on which the machine rests. The head of the machine swings on two long links, pivoted to the bed plate. A bench is provided at the left of the molder for holding flasks, small tools, etc.

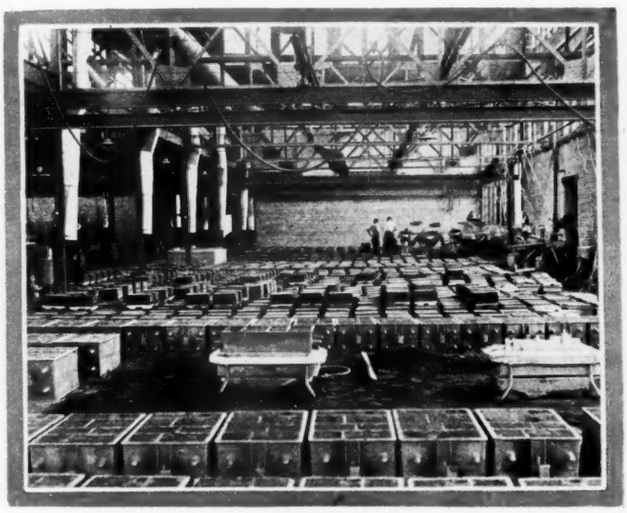


FIG. 3—A PORTION OF THE MOLDING FLOOR SHOWING FRESH AIR PIPES.

A white metal pattern plate is employed and inasmuch as the casting is symmetrical, only a half pattern is necessary. The mold is made in a snap flask, the drag being shown at the right and the cope at the left in Fig. 2. The core may be seen resting on the top of the cope in this illustration, the pattern plate being plainly shown in the background. A single runner extends through the cope, terminating in a four-point star gate, which feeds the arm from its underside, as indicated in Fig. 2. No graphite facing is used, the mold being finished with talc, which has given good results. The casting weighs 10 pounds, finished, the metal sections having an average thickness of 3/16-inch. One man puts up 140 molds per day and the losses due to defective molding or careless pouring are said to be something under 3 per cent.

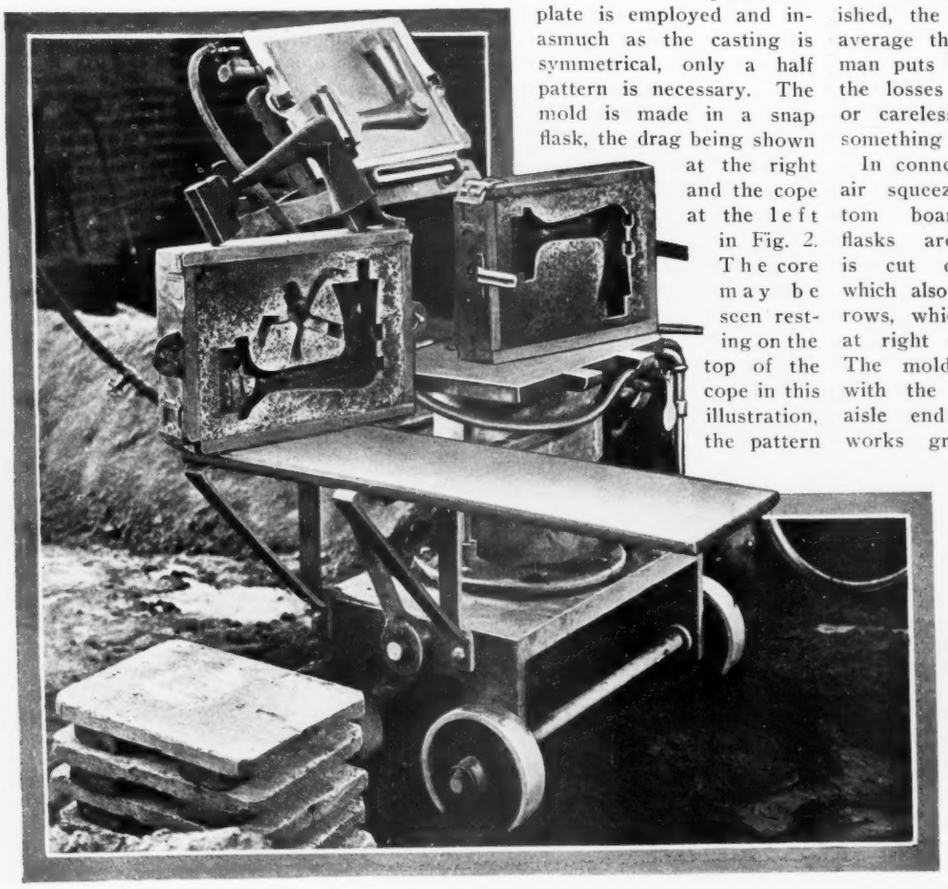


FIG. 2—FOR MOLDING ARMS A SPECIAL AIR SQUEEZER MACHINE HAS BEEN DEVELOPED

In connection with this swing-head air squeezer ordinary wooden bottom boards and hinged snap flasks are employed. The sand is cut over by a night gang which also piles it in heaps or windrows, which extend across the floor at right angles to the main aisle. The molder starts his day's work with the machine at the inner or aisle end of the sand heap and works gradually back toward the wall. The machine rolls on a paved strip and may be moved easily. An air pressure of 100 pounds per square inch is maintained. Fig. 8 shows the method of making the dry sand cores for the arm, using a special type of cast iron core box. In this illustration the two halves of the core box are shown at *A*, the core drier, which is also cast iron, is shown at *B*, and the special brass separator may be seen at *C*. A fairly heavy oil sand mix-

ture is used. In using this apparatus, both halves of the core are rammed up, the brass separator being fitted to one half of the box in order to provide an excess of about 1/16-inch of sand for the parting. After the two halves are struck off, suitable rods and wires being used to stay the core, the brass separator is removed and the core is booked without it, the excess sand at the parting forming a firm, homogeneous joint. In the final operation, one-half of the core box is removed and the drier substituted, after which the core is rolled over and the other half of the box is removed. The complete core, half of it resting in the drier, is then transferred to the oven and baked. Formerly the arm cores were made in halves and pasted together after baking. The latter operation has been entirely eliminated by the use of the separating shim and the production has been very materially increased. At present, one man working at a bench makes 170 good cores in a 9½-hour day. This is at the rate of 18 cores per hour, or approximately one core every 3½ minutes. No vent wax is used, the structure of the core itself being depended upon to carry away the gases properly. It will be noted in Fig. 2 and in Fig. 8 that the core has heavy prints at both ends, forming an ample area for the escape of gas. Many of the smaller symmetrical cores are made on the same principle, using a brass separating strip. In several of these cases only a half core box is employed, the drier taking the place of the other half of the box. The present method of molding the hand or balance wheels, utilizing a swing-head, air squeezer, manufactured by the Berkshire Mfg. Co., Cleveland, and a special horn gate match-plate, is shown in Fig. 1. This method is the result of several years' study and experiment. Formerly the balance wheels were molded four in a flask, with run gates. Considerable trouble was experienced from cold shuts and from the arms separating from the run. The adoption of machine molding did away with some of this trouble, but the main difficulty seemed to lie in the method of gating. It was finally decided that in order to get a satisfactory, clean, homogeneous metal it would be necessary to resort to a bottom-pour gate. However, in order not to cut down the production, it was essential that a gate suitable for use with a match-plate be designed. The hinged horn gate shown at *H*, Fig. 1, was the final result. The construction of the reverse side of the plate is indicated by the prints in the cope mold, shown at the right in Fig. 1. As this illustration indicates, the two horns are joined together on the back of the plate and are pivoted to a single hinge. The horns are circular in shape and if the two circles which they describe were completed, a cylinder would be defined. The hinge lies in the axis of this cylinder, thus making it possible to draw the gate from the sand properly.

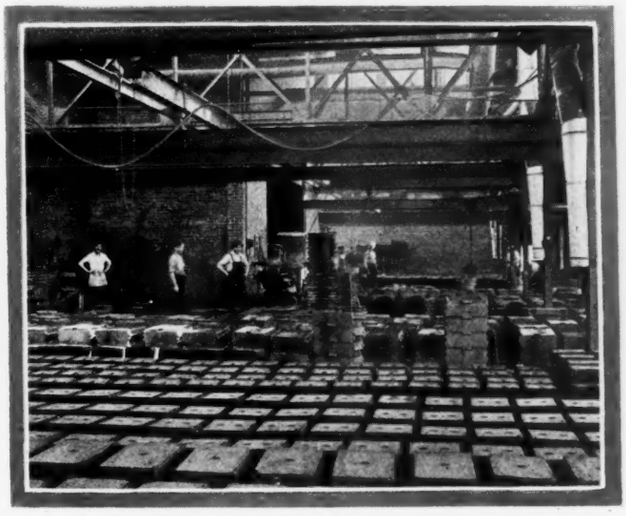


FIG. 4—ANOTHER SECTION OF THE MOLDING FLOOR

In making the mold, the drag, shown under the head of the machine in Fig. 1, is first filled with sand and the match-plate is then fitted to the flask pins with the horn gate extending down into the drag. The cope is next put in place, filled with sand and the mold is squeezed. After the head of the machine is swung out of the way, the cope is withdrawn and set off to one side, as shown at the right in Fig. 1. The horn gate

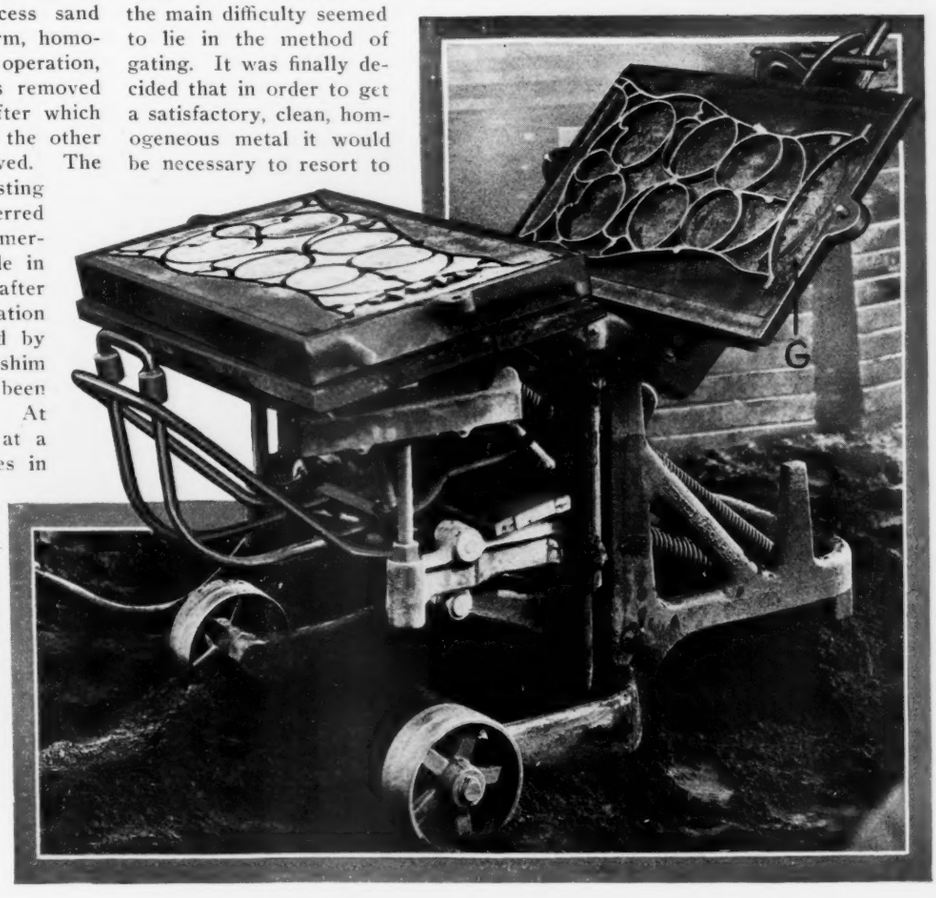


FIG. 5—THE LEGS ARE MOLDED ON A ROCK-OVER DROP MACHINE

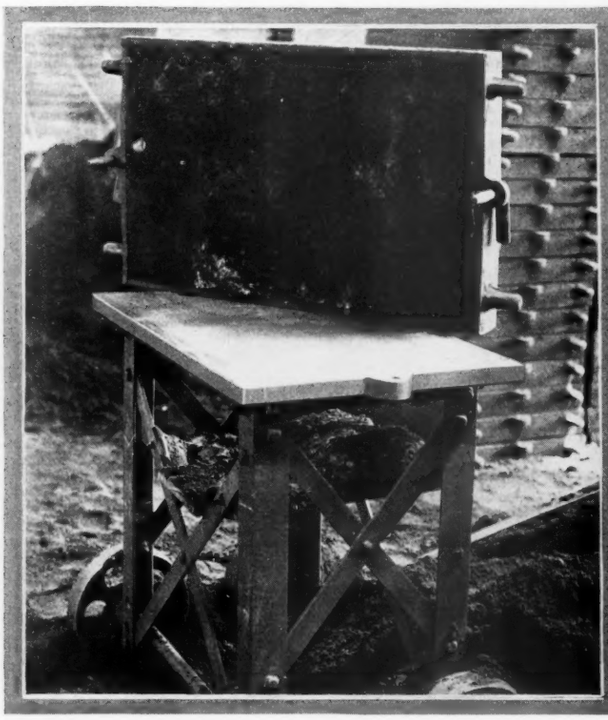


FIG. 6—CAST IRON COPE STAND FOR MOLDING LEGS

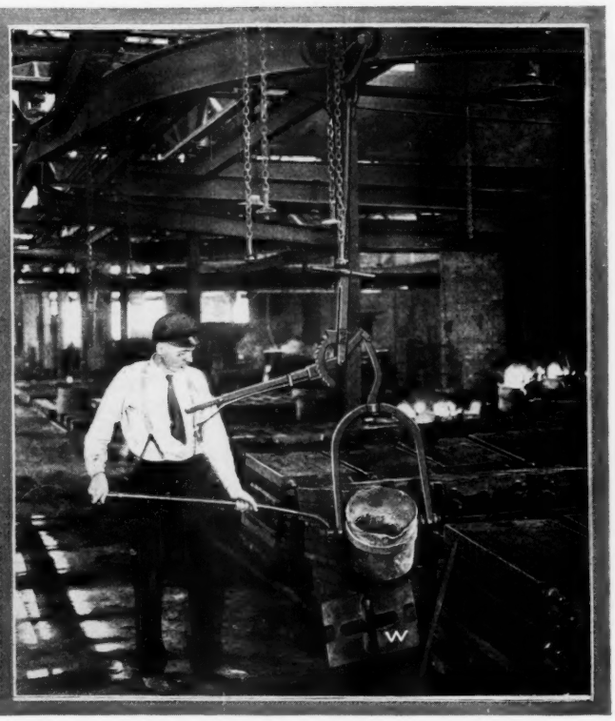


FIG. 7—SPECIAL POURING DEVICE, CARRYING 250 OR 500-POUND LADLES

is held in place by two buttons on the cope side of the plate. As soon as the cope is removed, these buttons are turned to one side, releasing the gate, which then is rolled back on the hinge. The horns have now been entirely removed from the drag. Therefore, there is no difficulty in removing the plate, the drag then appearing as illustrated in Fig. 1. Since this type of gate has been adopted, the losses have been reduced to less than 5 per cent, and with two balance wheels in a flask a molder turns out an average of 330 good castings per day. These castings weigh 3¼ pounds and, taking the sprues into account, it is necessary for the man to handle over 1,500 pounds of metal in pouring-off his floor. A 13 x 16¼-inch snap flask is used, both the cope and the drag being 3½ inches in depth. As shown in Fig. 1, the drag is fitted with extra long, machined flask pins to facilitate drawing the pattern. The pattern plate is white metal, the patterns themselves being brass. The horn gates are white metal and the plate is equipped with a pneumatic vibrator. In addition to the horn gate, a small dry sand strainer, shown on the lower right-hand corner of the match-

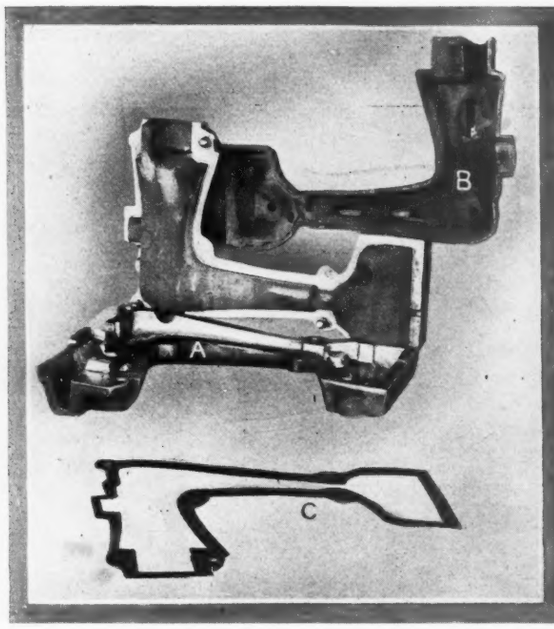


FIG. 8—CORE BOX, CORE DRIER AND SEPARATOR FOR MAKING ARM CORES

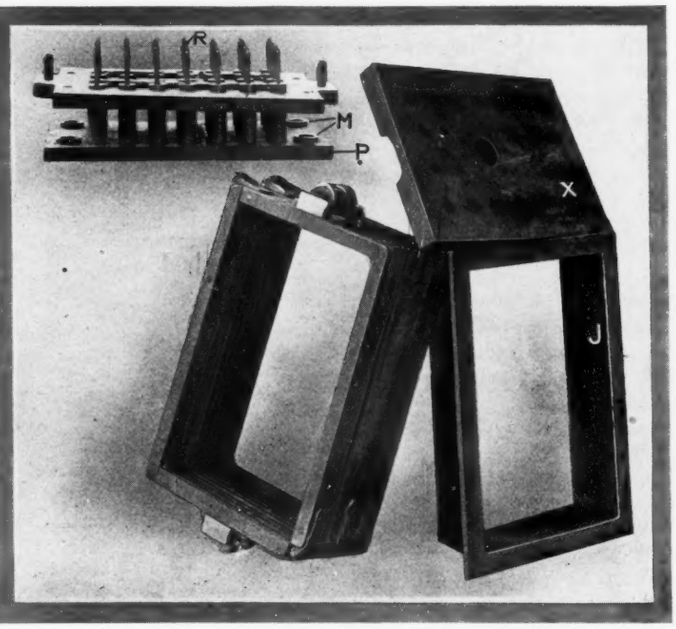


FIG. 9—SPECIAL STRIPPING PLATE RIG FOR MOLDING BUSHINGS

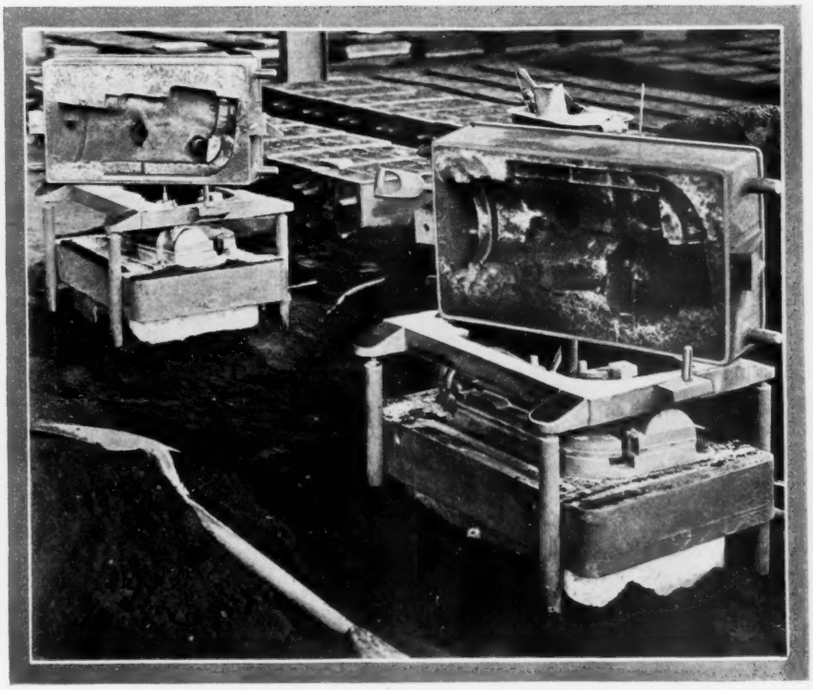


FIG. 10—JAR-RAM STRIPPING PLATE MACHINES MOLDING CREAM SEPARATOR FRAMES

plate, Fig. 1, is placed in the upper end of the runner to catch any slag or extraneous matter that might injure the metal in the casting.

For molding the legs, a rock-over drop machine, furnished by Henry E. Pridmore, Chicago, is utilized for making the drag, the copes being rammed on a stand of special design. Fig. 5 shows the drag mold and Fig. 6 the cope mold. In the former illustration, the pattern may be seen attached to the rock-over board of the machine. This job presents some difficulties, owing to the unusually thin sections employed and to the great area of metal exposed to the cooling action of the sand. The casting weighs only 10 pounds; its over-all length, however, is approximately 28 inches, while the width at the bottom is 17 inches. A 19 x 32-inch cast iron flask is employed, both the cope and drag being 3¼ inches in depth. All of the mold is made in the drag, the cope simply forming a cover. The casting is poured through one runner at the upper end, the gate being shown at *G*, Fig. 5. It is claimed that the losses are less than 2 per cent.

The cope is rammed by hand on a stand, Fig. 6, which was designed in the King Sewing Machine Co.'s shop. It consists of a structural steel frame, carrying a machined, cast iron top. The top is provided with ears in which the flask pins fit. The stand is mounted on wheels, so that it can be moved along the sand heap as the work progresses. It is extremely substantial and has been found to be much more satisfactory than the wooden stands previously employed. It is believed that an iron stand will last practically indefinitely, whereas the wooden stands had to be renewed frequently.

Two floors are set aside for this job, six men being employed. The two molding machines and two cope stands each require one man and the remaining two men are employed in closing molds, handling flasks, etc. In order to save floor space the flasks are stacked three-high, as shown in Fig. 7. They are inclined slightly so that the metal enters the mold under a moderate head. Each mold is poured separately, the three flasks in each stack being arranged with their ends stepped, properly exposing the runners. The molds are poured successively, commencing at the bottom, using a special pouring device, Fig. 7, which will be described in greater detail later. A notched weight is placed over the runner on each flask to protect the sand at that point and the throat of the notch is oiled in order to prevent the hot iron from sticking to the weight. The weight of the mold is sufficient to eliminate the necessity for using clamps, but as an additional precaution, a 60-pound flat weight, shown at *W*, Fig. 7, is placed on each stack.

The six men previously mentioned, using two Pridmore rock-over drop machines and two cope stands, turn out an average of 425 molds per day. In pouring-off their floors, it is necessary, therefore, for them to handle over 6,500 pounds of metal.

An interesting example of one of those temporary expedients to which every foundryman occasionally is obliged to resort, is found in the method of molding back braces at the bench in a large snap flask. The job is shown in Fig. 12. The general characteristics of the casting are clearly indicated in this illustration. The match-plate is 15 inches wide and 26 inches long. This brace was recently redesigned and in its present enlarged form should be handled on a molding machine. Suitable machines and other

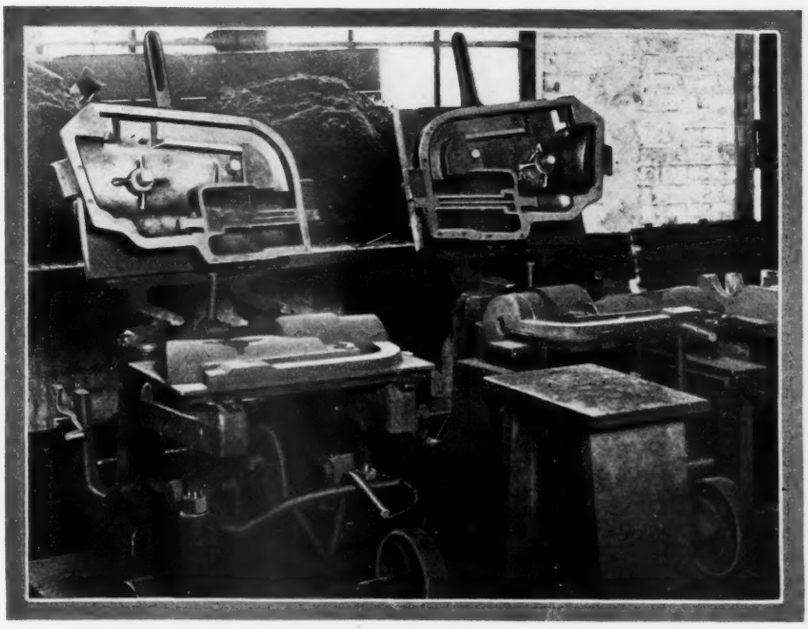


FIG. 11—THE CREAM SEPARATOR CORES ARE MOLDED ON SMALL ROCK-OVER MACHINES

equipment, however, were not available and it was necessary to get out a large number of castings in a short time. Therefore, a white metal match plate was made and fitted with roll-up hinges as in stove foundry practice. A 15 x 26-inch snap flask with a 2½-inch drag and 3½-inch cope was provided, together with a temporary bench.

The flask could not be hinged at the corners in the ordinary manner on account of the roll-up hinges. Therefore, the back was sawed in two and a couple of ordinary strap hinges were provided, as shown at the left in Fig. 12. Both the cope and the drag are equipped in this manner. The flask is locked together at the front corners and may be easily removed after the mold is made without disturbing the match-plate or the roll-up hinges. The match-plate is fitted with a pneumatic vibrator, which is said to be of considerable assistance in rolling the pattern out of the sand.

It also is believed, however, that a more accurate casting is produced than if the match-plate were rapped on the ears in the ordinary manner. This mold weighs 80 pounds, the casting, however, weighing only 4½ pounds. One man puts up a floor of 85 boxes in a day. The molds are poured in temporary wooden jackets. For all of the permanent snap flask work in the shop, heavy cast iron jackets have been provided.

Fig. 9 shows a special stripping plate equipment, designed for making small gray iron bushings of various sizes. With this rig, 28 bushings may be molded at one time, one man putting up 100 flasks per day, using a Berkshire machine. The flask is 12 x 18 inches and all of the mold is made in the cope, the drag simply forming a sand bed. Formerly these bushings were attached to a wooden pattern board and were molded horizontally, 12 in a flask. The adoption of the rig shown in Fig. 9, therefore, has increased the production from 1,200 to 2,800 bushings per day. When pouring, the cast iron jacket *J*, Fig. 9, which is similar to the other jackets used throughout the plant, is used. The mold is secured by the weight *X*. It will be noted that there are four rows of small holes in the weight, corresponding with the riser prints *R*. The riser prints are about ⅜-inch in diameter, one being attached to each bushing to insure sound metal. The several patterns are fixed to the base plate *P* and the length of the bushings may be varied by changing the four washers, *M*, which separate the base plate from the stripping plate. When thick washers are used, the bushings are short and *vice versa*, the maximum length of bushing being obtained when no washers are used; in the latter case the stripping plate rests directly on the base plate during the ramming operation. The bushings slide through removable rings or collars, which are fitted into the stripping plate.

On this account the diameter of the bushings may readily be changed simply by unscrewing the patterns from the base plate and substituting new models of a different size, at the same time changing the collars or rings in the stripping plate to correspond. These bushings are among the smallest pieces made in the King shop. None of the castings turned out, however, are very heavy, the average weight of all the work being only five pounds.

The treadles are molded on squeezer machines furnished by the Adams Co., Dubuque, Ia. They are put up in 13 x 24-inch snap flasks, the drags being 3 inches and the cope 4 inches in depth. One man makes 145 molds per day.

The band wheels, which are about 12 inches in diameter, are molded on match-plates and to simplify the molder's work all of the pattern except a portion of the rim is placed on one side of the plate. A horn gate similar to that used for the balance wheels, Fig. 1, is employed. The molds are made on Adams squeezer machines, one man turning out 210 per day. Besides sewing machine parts, the King factory turns out a large

Details of Cupola Charge on June 22.

Kind of Material.	Pounds per charge.	Total charged, pounds.	Per cent of total.
Susquehanna pig	1,000	9,000	25
Wickwire pig	1,000	9,000	25
Southern pig	400	3,600	10
Shop scrap	1,600	14,400	40
Total metal	4,000	36,000	100
Jamison coke, bed charge	.....	1,650	..
Jamison coke, regular charges	.....	3,010	..
Flux	.....	300	..
Total coke and flux	.....	4,960	..
Melting ratio	.....	1:7.75	

Results From Heat.

	Pounds.	Per cent.
Good castings	23,725	66.0
Bad castings	2,000	5.5
Sprues	5,600	15.5
Over iron	3,500	9.7
Cupola loss	1,175	3.3
Machine shop return	none	0.0
	36,000	100.0

Blast on 3:10 p. m.; blast off, 5:15 p. m. Elapsed time, 2 hours 5 minutes. Blast pressure, 9.5 ounces. Iron in 15 minutes after blast turned on. Average cost of metal, per net ton, $12.27.

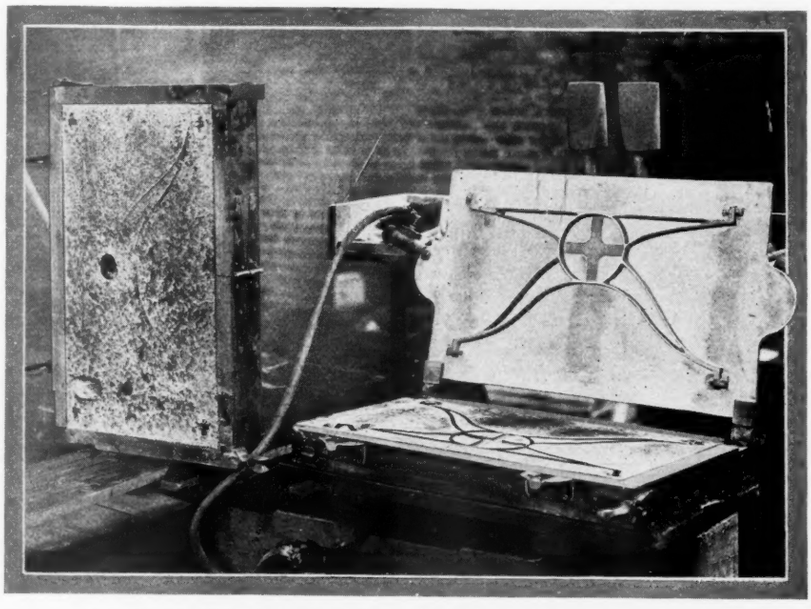


FIG. 12—SNAP FLASK RIG FOR MOLDING LARGE BACK BRACES

number of castings for cream separators. One of the most interesting jobs in this connection is shown in Figs. 10 and 11, Fig. 10 showing the principal features of the molding operation, and Fig. 11 the core work. This casting, called the separator frame, is made in a two-part cast iron flask, using a jar-ram, stripping plate machine of the Mumford type, built by the Mumford Molding Machine Co., Chicago. The flask is 15 inches wide and 26 inches long, the cope being 6 inches and the drag 7 inches in depth. The casting weighs 56 pounds and three men turn out 165 molds per day. The same gang puts up 190 molds from a somewhat smaller pattern. The casting is approximately symmetrical, the pattern being split through its long axis.

The cores are molded on Pridmore rock-over drop machines, as shown in Fig. 11. The core is made in halves and is baked and pasted together in the ordinary manner. The machines are operated in pairs, one working on each half of the core.

The same metal mixture is used both for the sewing machine and the cream separator parts. It is melted in a No. 7 Whiting cupola lined to 54 inches inside diameter. The cupola melts 350 pounds per minute, or approximately 10.8 net tons per hour, with a melting ratio of one pound of coke to eight pounds of iron. To satisfy the requirements of the machine shop, an extremely soft metal high in silicon is provided. The average analysis is as follows: Silicon, 3.10 per cent; phosphorus, 0.65-0.75 per cent; manganese, 0.55-0.65 per cent, and sulphur, under 0.07 per cent. The cupola is operated with a blast pressure of 9½ to 10 ounces per inch. To give a clearer idea of the cupola operation, a table, showing the details of the melt on June 22, 1915, is presented on page 350.

Over-Iron a Large Item

As this table indicates, the over-iron is a rather large item on account of the great number of light castings poured. Instead of pouring this metal into pigs, as is customary, the King Sewing Machine Co. is considering the possibility of utilizing it for sash weights. It is believed that this will be a more economical proposition than remelting the iron; also it will tend to keep down the sulphur in the mixture.

For distributing the metal throughout the shop, an I-beam trolley system, manufactured by the Curtis Pneumatic Machinery Co., St. Louis, has been installed. Where hand ladles are used, the iron is brought to the molder's floor in 250 or 500-pound trolley ladles. for reaching a few floors not equipped with the trolley system, 250-pound bull ladles are utilized. They are rested on horses while the metal is transferred to the hand ladles. For lining both the ladles and the cupola, a high-grade red New Jersey fire clay mixed with coarse New Jersey fire sand is utilized. In addition to the bull, trolley and hand ladles, the pouring device, shown in Fig. 7, is used. Its construction is clearly outlined in the illustration. It consists of a suitable trolley to which a suspension rod, leading to the ladle yoke, is attached. The suspension rod is provided with a turnbuckle, so that its length may be adjusted. The ladle yoke is carried by a ratchet lever which is used to adjust the ladle to the exact height required after the approximate height has been fixed by the turnbuckle. This device is used either with 250 or 500-pound ladles. It greatly increases the speed and capacity of the pouring gang.

The water for wetting down the sand heaps is kept in a large concrete tank located in the middle of the molding room. The roof of the molding room is of depressed bay construction, affording ample natural illumination. The shop is ventilated in summer and heated in winter by means of an air circulating system. The pipe or ducts carrying the fresh air are shown clearly in Fig. 3. The core room, which is provided with a six-section, five-drawer, Smith type oven, is similarly ventilated.

The cleaning room is equipped with six tumbling mills of various sizes, an automatic sand blast barrel and a sand blast room furnished by the W. W. Sly Mfg. Co., Cleveland. Six double grinding wheel stands are provided, together with pneumatic chipping hammers and other apparatus.

Making Car Wheels at the Lenoir Car Works

By G S Evans

AT THE conclusion of a series of practical tests conducted with a view of determining the effect of different mixtures of irons and alloys on the strength of chilled car wheels, the writer was asked by the engineer of tests of one of the largest consumers of chilled car wheels in the United States, who had witnessed part of the tests and had seen wheels cast from our regular mixture repeatedly show up stronger than those cast from special mixtures: "How do you explain the results of the tests and what in your opinion makes the strongest and most durable chilled car wheel?"

This question was asked after what I believe to be the most far-reaching test of the kind ever made on car wheels. It extended over a period of several months, during which time the cupola was run on over 100 different mixtures, containing varying percentages of different kinds of pig iron, scrap wheels, structural steel and the ferro-alloys of manganese, titanium, vanadium, nickel-chromium and many non-ferrous alloys.

Some of the mixtures contain as much as 60 per cent steel, others 85 per cent pig iron, both charcoal and coke pig, and still others as much as 98.5 per cent scrap wheels, from which wheels were cast that would meet the requirements of the latest Master Car Builders' Association specifications. Over 15,000 wheels were cast from the special mixtures, of which more than 1,000 were tested to destruction according to the M. C. B. A. drop and thermal tests.

The summary of the tests indicated that wheels cast from our regular mixture were more constant, generally stronger and consequently more reliable under service than the wheels cast from the special and more expensive mixtures. Hence the question: "How do you explain the results of the tests" and the answer was always, "foundry practice." Foundry practice is governed largely by environment and necessarily must vary in different foundries to suit local conditions. In a wheel foundry it naturally resolves itself into four main divisions: The mixture, melting, molding and annealing, each varying with and dependent to a certain extent upon the other; and on account of the bearing of one upon the other, prescribed rules of foundry practice are oftentimes misleading to the average foundryman. Every foundryman must work out the best methods of procedure for his particular foundry. This cannot be accomplished in a day, even by the most expert foundryman, but only by the slow process of evolution, evolved as a result of carefully planned, systematic experiments, with close and attentive observation and profitable use of past experiences. The foundry in question was taken over by the Lenoir Car Works over five

years ago. At that time the cupola was operated on a mixture of 20 per cent southern charcoal pig and 80 per cent scrap wheels, the mixture having been figured by the thumb-and-finger rule, or the occult method of fracture grading; testing each for chilling qualities and strength, both as melted straight and with mixtures of scrap wheels and steel. By this method three brands of iron were selected which showed the most suitable properties. Never less than two card is returned to the chemist with the instructions that the bin is again empty. This, with the record kept in the laboratory, gives two complete records of each car and avoids the possibility of getting the different grades of iron

Table I

	Silicon, Per Cent.	Sulphur, Per Cent.	Manganese, Per Cent.	Phosphorus, Per Cent.	Carbon, Per Cent.
Gross analysis as charged into the cupola.....	0.77	0.095	0.68	0.42	3.10
Average analysis of the cast	0.63	0.125	0.59	0.42	3.47

Table II

	Silicon, Per Cent.	Sulphur, Per Cent.	Manganese, Per Cent.	Phosphorus, Per Cent.
Scrap wheels	0.672	0.124	0.53	0.39
Steel springs	0.06	0.05	0.40	0.03
Steel punchings	0.04	0.03	0.40	0.03
Pig iron, No. 1	1.48	0.049	0.47	0.78
Pig iron, No. 2	1.74	0.034	0.64	0.63
Pig iron, No. 3	2.19	0.030	0.38	0.81
Ferro-manganese	....	.....	80.00	....

consequently, considerable trouble was experienced in getting the wheels past the inspector. One of the first things that the new manager did was to employ a chemist, build and equip a laboratory with all the essentials, including physical testing machines, pyrometers and a complete metallographic outfit. When this was done, experiments were begun with a view to improving the product (chilled wheels) and the foundry methods generally.

Opposition of Foundry Superintendent

The manager was not familiar with foundry practice, although the chemist—only one year out of college, with a working knowledge of chemistry in the laboratory—knew nothing of its application in the foundry, while the foundry superintendent was inherently opposed to any and all experiments. He was accustomed to the thumb-and-finger rule of foundry practice and naturally was opposed to the advent of Mr. Silicon, Mr. Manganese and their associates into the realm of his acquaintances; consequently, it was necessary *to go slow.* However, after a short time, the mixture was being figured on a chemical basis. Then followed slight changes in the mixture. First, part of the No. 6 pig was replaced by steel scrap, beginning with less than one-half of 1 per cent and gradually increasing the amount every few days, after noting the effect of the preceding, on the strength of the finished wheels. This gradually was increased, so long as any good effect could be noticed. By this method the strength was materially increased, and as a result, the superintendent was again on speaking terms with the inspector, but he was not yet reconciled to the chemist.

How the Mixture was Changed

Sample cars of several brands of southern coke pig were obtained and the value of each was determined by melting a series of like mixtures made from each of the different irons, in a test cupola provided for the purpose, different brands, and oftentimes three, were used in the mixture, always selecting the pigs from three or more separate cars or piles of iron, to correct possible variations in the composition of different parts of the cars.

The change in the mixture effected a saving of several thousand dollars during the following year, but this was not done at a sacrifice in the quality of the wheels, as the daily tests continued to show increases in the strength. The upward trend of the strength is accountable entirely to improvements in foundry practice which were co-incident with the changes in the mixture, and without which it would have been impossible to obtain the high strength in

Lenoir Car Works

UNLOADING CARD

Car No. B&O 105648
Recd 2-14-15. Analyzed 2-14-15.
Containing #3 Woodward
Specification No. 3 O.K.
Unload Wheel shop Bin 13
Remarks

H.E. Copeland
Chemist
Out 4/28/15.

FIG. 1—PIG IRON UNLOADING CARD

the finished wheels, as indicated by the average breaking strength of 66.1 blows of the drop test.

How the Iron is Purchased

All pig iron is bought on specifications and each car is analyzed for silicon sulphur, manganese and phosphorus before being unloaded. If found to meet the requirements of the specifications, it is assigned to a certain bin or location in the yard and the unloading card, Fig. 1, is tacked onto the car. After it is unloaded, the card is removed from the car and placed in a rack at the side of the bin containing the iron. When the iron is used the mixed. Analyses are made of scrap steel and scrap wheels every 60 days and the results are taken as constants until further analyses are made. These being constant, they are taken as a base upon which the mixture is built.

Car Wheel Mixture

At the present time the car wheel cupola is being operated on the following mixture:

	Per Cent.
Scrap wheels	78.4
Scrap steel springs	5.0
Structural steel	3.3
Southern coke pig	13.3

The gross analysis of the mixture as it is charged into the cupola, and the average resultant composition of the metal as cast, are given in Table 1.

Importance of Silicon and Manganese

In figuring a mixture, it is practically impossible to bring each of the elements precisely to the standard, therefore it is necessary to determine upon one or two elements which are the most important in affecting the properties of the particular product and to bring these to the required figures, taking care of the other elements. This is accomplished generally by the selection of the scrap and brands of pig, rather than the specific analysis of individual lots. Silicon and manganese, assuming that the other elements are in line with accepted standards for car wheel mixtures, are the two principal elements influencing the chilling capacity and strength of car wheel iron.

The former influences by direct action upon the carbon, and the latter by its action upon sulphur and occluded oxygen gas, both of which in turn influence the condition of the carbon in the finished wheel. A slight variation of either of these from the standard affects the chill and strength much more than like variations of any of the other elements. Silicon and manganese are taken as the bases and by the use of different grades of pig iron and ferro-manganese, are always brought to the standard figures, or composition given in Table I.

Phosphorus is held fairly close to the standard by the selection of the brands of pig used in the mixture, and sulphur and carbon are adjusted in the cupola during the melting.

With scrap wheels as a constant to build upon and with a number of different grades of pig in the yard with varying analyses to select from, figuring the charge is accomplished by a simple process and does not require knowledge of chemistry other than a working familiarity with the different elements.

The charge illustrated in the Daily Report of Operations, Fig. 2, which is made up of the irons given in Table II, is figured as follows: First, multiplying the gross per cent of each of the elements in the mixture (shown in the first line of Table I) by the number of hundredweights (60) in the total charge

0.77 × 60 = 46.2 pounds of silicon
0.095 × 60 = 5.8 pounds of sulphur
0.68 × 60 = 40.8 pounds of manganese
0.41 × 60 = 24.6 pounds of phosphorus
3.10 × 60 = 186.0 pounds of carbon

gives the actual weight of each of the elements required in the charge. In the same manner multiplying the analysis of each of the irons given in the charge by the amounts used, gives the actual weights of each of the different elements contained in each of the components of the charge, as follows:

Pounds.		Silicon, Pounds.	Manganese, Pounds.
4,700	scrap wheels contains	31.48	24.91
300	steel springs contains	.18	1.20
200	steel punchings contains	.06	.80
300	No. 1 pig contains	4.44	1.41
200	No. 2 pig contains	3.48	1.28
300	No. 3 pig contains	6.56	1.14
12.5	ferro-manganese contains	....	10.00
	Total	46.20	40.74

It will be noted that the total of the silicon and manganese columns equals the amounts of each required in the charge.

The other elements, as a rule, are not figured each day. However, by figuring in the manner described, the results obtained will check very closely with the gross analysis given in Table I.

In regular practice the charge is made up daily by the chemist, and is reported to the foundry superintendent on the form, Fig. 2, after which it is passed to the foreman in charge of the cupola.

Molybdenum and Copper

(*Continued from Page* 344)

one, seemed to indicate that a trace of the molybdenum was dissolved by the copper.

These experiments proved conclusively that an alloy of molybdenum and copper could not be made in a fuel-fired furnace and, therefore, it was decided to make a 10 per cent molybdenum copper in an electric furnace. A total of four trials was made. In each of these experiments 200 grams of granulated electrolytic copper were intimately mixed with 20 grams of pulverized metallic molybdenum and the mixed metals were charged in a small arc furnace, formed by an 8-inch square block of carbon, 10 inches high, having a hole 3 inches in diameter by 6 inches deep in one end to form the inside of the furnace. The electrode was a graphite rod, 2 inches in diameter adjusted centrally to the furnace. The electrode was carried by a horizontal arm that could be raised or lowered on two uprights, by means of a screw and hand wheel. The arc first was struck and the furnace heated, after which the charge was added, a small amount at a time, the electrode having been raised gradually as the run proceeded. At the beginning of the test the current was 300 amperes at 30 volts and later was raised to 550 amperes at 50 volts. The ingot copper was allowed to cool in the bottom of the furnace and in the first experiment the molybdenum was found in the metallic state embedded in the upper part of the ingot.

The conclusion arrived at was that the run had not been conducted a sufficient length of time to generate the heat necessary to fuse the molybdenum and, therefore, the next experiment was carried out with greater care and a very high temperature was attained. The ingot from this test contained the molybdenum imbedded in the bottom and the latter metal was not changed in any way. The ingot was sawed half way through and then split. As a result, the grains of molybdenum were broken apart, which indicated that they were tightly imbedded in the copper. The fracture of the grains of molybdenum was the same as before the metal was exposed to the heat.

In the fourth experiment, the molybdenum was first fused and then the copper was added carefully. In this instance the molybdenum was entirely melted and was found in the form of irregularly-shaped globules which were scattered throughout the ingot.

LENOIR CAR WORKS—Foundry Dept. Form 109 Revised 6-5-15. 2 M C 46988

DAILY REPORT OF OPERATIONS

Wheel Department Lenoir City, Tenn., July 20 1915

WHEELS MADE AND LOST									WHEELS ON HAND AND SHIPPED	
33"	Wt.		Wt.		Wt.	Made	Bad	Wt.	Balance on Hand 191	
									Wheels Made	
									Balance	
									LESS Test Wheels	
									Bad Wheels	
									Wheels Shipped	
									Balance on Hand	

CUPOLA CHARGING SHEET

Car No.	Location	Brand	Grade	Pounds Per Chg.	No. Chgs.	Total Iron	Remarks
		Scrap wheels		4700			
		Steel Springs		300			
		Steel punchings		200			
PC 34103	Bin	#3 Woodward & F		300			
MRO 40337	" 6	pioneer	#3	200			
MP 36068	" 7	"	#3	300			
		Ferro Manganese	80%	13½			
Total				6013½			
LESS Return Scrap							
Net Amt. Used							

CHEMICAL COMPOSITION	
Elements	Gr. Per Cent.
Silicon	.77%
Sulphur	
Manganese	.68%
Phosphorus	
Comb. Carbon	
Graphite	
Total	

Net Weight
Melting Loss
Coke to Bed
Coke Per Chg.
Total Coke
Limestone Per Chg.
Total Limestone
Blast On:
First Iron:
Bottom Dropped:

FIG. 2—DAILY REPORT OF OPERATIONS AND CUPOLA CHARGING SHEET

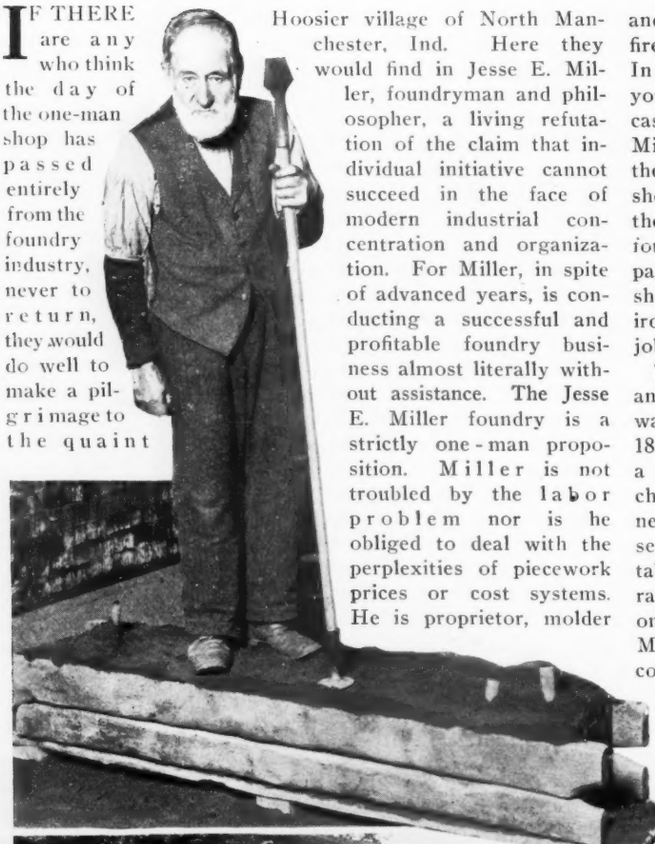
Jesse E. Miller---Master Foundryman at 77 Years

Off the Beaten Track and Away from the Hurly-Burly of Life, This Pioneer Plies His Vocation With the Contentment of a Philosopher

By L Mackibbin

IF THERE are any who think the day of the one-man shop has passed entirely from the foundry industry, never to return, they would do well to make a pilgrimage to the quaint Hoosier village of North Manchester, Ind. Here they would find in Jesse E. Miller, foundryman and philosopher, a living refutation of the claim that individual initiative cannot succeed in the face of modern industrial concentration and organization. For Miller, in spite of advanced years, is conducting a successful and profitable foundry business almost literally without assistance. The Jesse E. Miller foundry is a strictly one-man proposition. Miller is not troubled by the labor problem nor is he obliged to deal with the perplexities of piecework prices or cost systems. He is proprietor, molder and coremaker all in one; also he charges his own cupola, fires the boiler and runs the engine that drives the fan. In addition, he is a patternmaker and machinist, and if you desire, will make the necessary patterns for your castings and machine them before they are delivered. Miller is obliged, therefore, to divide his time between the foundry, the patternmaker's bench and the machine shop. This he does with eminent success and few are the customers who are turned away from the Miller foundry on account of lack of facilities. A reference to page 75 of Penton's Foundry List indicates that Miller's shop is equipped to make brass castings as well as gray iron. This is a combination over which the greatest of jobbing foundries could claim little advantage.

The proprietor is a quiet old man with a kindly face and on his brow rests the dignity of contentment. He was born in Tippecanoe county, near Lafayette, Ind., in 1838, and his foundry experience spans practically half a century. When Mr. Miller first settled in North Manchester the surrounding country was a howling wilderness containing no human habitations save the rude settlements of a few adventurous homesteaders who had taken up claims from the government. There were no railroads, the Wabash canal, built in 1832, forming the only artery of communication with the outside world. Mr. Miller gives an interesting account of industrial conditions in the early days. Once, he says, there was a flood on the Wabash river which swept across the canal and tore out the tow path. In rebuilding the



JESSE E. MILLER BUTTING-OFF THE LAST MOLD AT THE CLOSE OF THE DAY'S WORK

THE FOUNDRY AND MACHINE WORKS OF JESSE EMANUEL MILLER, NORTH MANCHESTER, IND.

THE OLD BRICK CUPOLA IS SAFELY BOUND WITH CHAIN

embankment, a large force of workmen were employed at 50 cents per day. The whole countryside was electrified as 50 cents a day was the highest wage rate for labor ever known up to that time. During this period, Mr. Miller made plow points and sold them direct to farmers. Later he did quite a business repairing traction engines along with general jobbing foundry work.

I found the old gentleman as you see him in one of the accompanying illustrations, preparing his molds. When I arrived he had just completed the last one and he took time to show me around his much beloved old place.

The venerable engine that drives the fan furnishing air to the cupola and also supplies power for the machine shop, itself has had quite a history. About half a century ago it was used in one of the first steam tow boats on the Wabash canal. Later it was acquired by Mr. Miller and installed in his shop, where it performs faithfully every day and, apparently, is equal to many more years of service. It is a tribute to the splendid workmanship of our early mechanics.

Simplicity in Cupolas

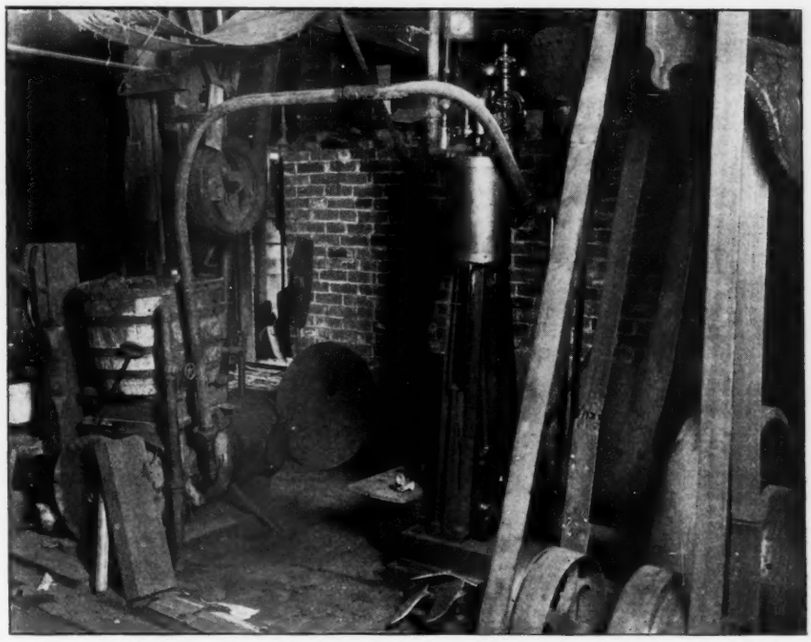
The old cupola is nothing more than a brick chimney with a chain bound around the bosh to hold it together. This chain, as one of the illustrations indicates, is kept at the proper tension by a motley assortment of wooden wedges. It also forms a convenient rack for files, slicks, trowels and other foundry tools. The charging floor is reached by a ladder and the old man carries up his pig iron and scrap, one piece at a time. The coke is handled in baskets in an almost equally primitive manner. The old cupola is fired up only three or four times a month and on the day the heat is taken off a farmer boy is hired to come in and help pour the metal.

So I found Miller, a wayfarer on a grassy path near the highway of progress, yet protected from the bustle and restless energy of modern industry. The very road that runs past the old shop is grass grown. Yet, amid his simple surroundings Miller is rounding out a contented and useful existence and even those who are most advanced in his chosen profession would look upon him with respect, since his achievements have been adequate to the necessities of his life and he is diligent in supplying the needs of his fellow men.

When the writer, with note book in hand, was interviewing Mr. Miller, his daughter, Miss Miller, a sweet young lady of 55 years or thereabouts, came up to the foundry door to call her father to dinner. I had the current issue of a magazine in my lap and Miss Miller evidently took me for a book agent. Her comment was an illuminating side light on the kind-hearted generosity of the old man.

"Don't subscribe for it, dad," she said.

The autumn meeting of the Institute of Metals will be held in the rooms of the Chemical Society, London, on Friday, Sept. 17. Among the papers to be presented are the following: "The Constitution of Brasses Containing Small Percentages of Tin—A Contribution to the Study of the Ternary System, Copper-Zinc-Tin", by Dr. O. F. Hudson and R. H. Jones; "Structural Changes in Industrial Brasses" and "Hardness of Copper-Zinc Alloys", by Dr. D. Meneghini;" Specifications for Alloys for High-Speed Superheat Steam Turbine Blading", by W. B. Parker and "Detection of Internal Blow-Holes in Metal Castings by Means of X-Rays", by C. H. Tonamy.



POWER IS SUPPLIED BY A HALF CENTURY OLD STEAM ENGINE THAT ONCE DID DUTY IN A CANAL BOAT

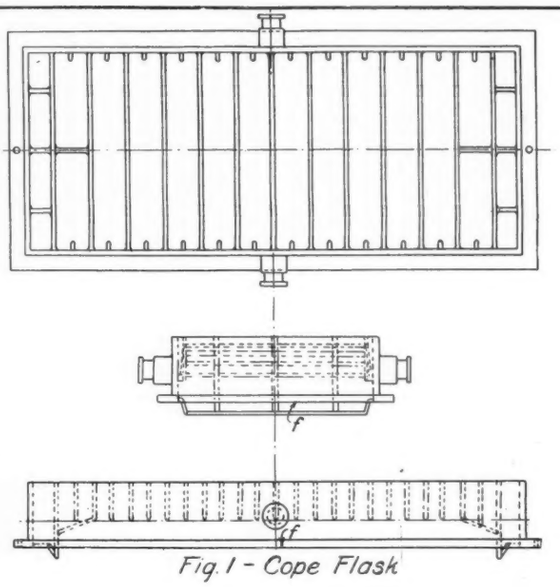


Fig. 1 - Cope Flask

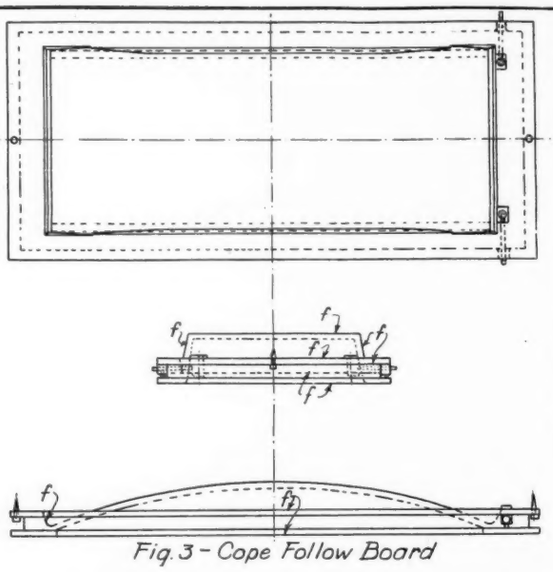


Fig. 3 - Cope Follow Board

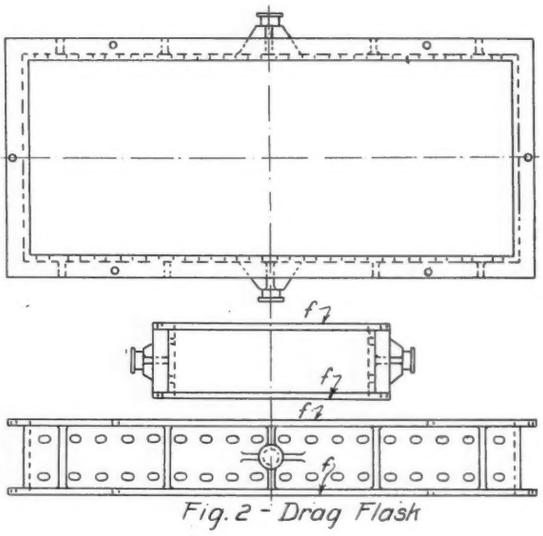


Fig. 2 - Drag Flask

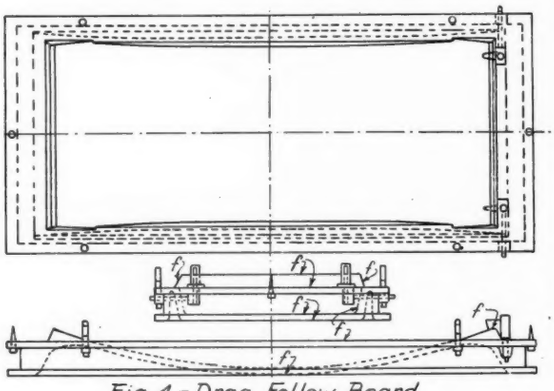


Fig. 4 - Drag Follow Board

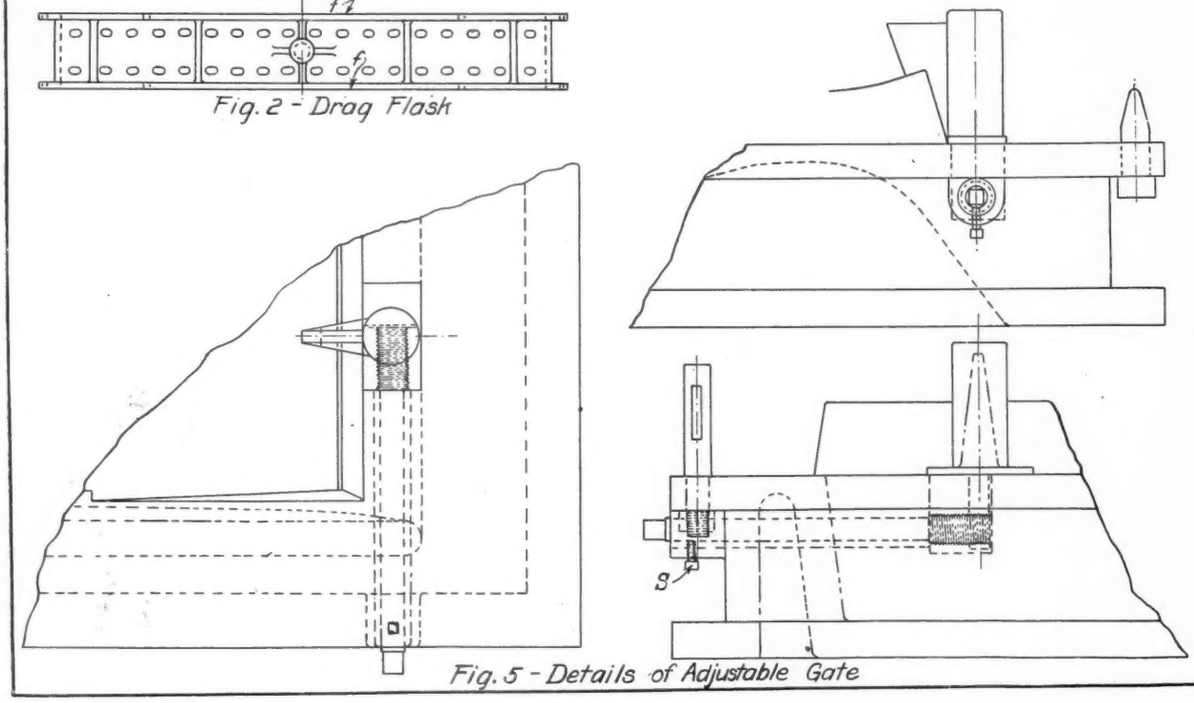
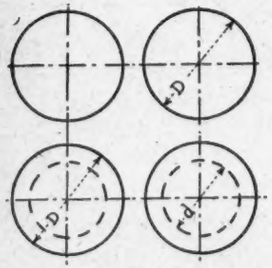


Fig. 5 - Details of Adjustable Gate

DETAILS OF FLASK AND FOLLOW BOARD FOR MOLDING TUNNEL SEGMENTS

WEIGHT OF BALLS OR SPHERES

By W. L. Tryon



In the accompanying tables are given the weight of balls or spheres in pounds for different diameters D.

To find the weight of a hollow ball, subtract the weight corresponding to the inside diameter d from the weight corresponding to the outside diameter D.

Dia. in in.	Weight of Ball or Sphere When Cast in: Cast iron.	Steel.	Alumi-num.	Cop-per.	Zinc.	Gun met-al.	Yel-low brass.
3/8	.007	.008	.003	.009	.007	.009	.008
1/2	.017	.019	.006	.021	.017	.021	.020
5/8	.033	.036	.012	.041	.032	.040	.039
3/4	.058	.063	.021	.071	.056	.070	.067
7/8	.091	.099	.034	.112	.089	.111	.106
1	.136	.148	.050	.167	.132	.165	.158
1 1/8	.194	.212	.072	.238	.189	.235	.226
1 1/4	.267	.290	.098	.223	.259	.319	.310
1 3/8	.354	.385	.131	.435	.345	.429	.413
1 1/2	.460	.500	.170	.564	.446	.556	.535
1 5/8	.586	.636	.217	.717	.569	.707	.680
1 3/4	.732	.795	.271	.896	.721	.884	.851
1 7/8	.900	.976	.332	1.10	.873	1.09	1.05
2	1.09	1.19	.404	1.34	1.06	1.32	1.27
2 1/8	1.31	1.42	.484	1.60	1.27	1.58	1.52
2 1/4	1.56	1.69	.575	1.91	1.51	1.88	1.81
2 3/8	1.83	1.99	.675	2.24	1.77	2.21	2.12
2 1/2	2.13	2.32	.788	2.60	2.07	2.56	2.48
2 5/8	2.47	2.68	.914	3.02	2.40	2.98	2.87
2 3/4	2.84	3.06	1.05	3.47	2.76	3.42	3.30
2 7/8	3.24	3.52	1.20	3.98	3.15	3.92	3.78
3	3.68	4.00	1.36	4.51	3.57	4.45	4.29
3 1/8	4.16	4.52	1.54	5.10	4.05	5.03	4.84
3 1/4	4.68	5.09	1.73	5.73	4.55	5.65	5.44
3 3/8	5.25	5.70	1.94	6.19	5.09	6.34	6.10
3 1/2	5.86	6.36	2.17	7.16	5.69	7.06	6.82
3 5/8	6.50	7.06	2.40	7.96	6.31	7.85	7.55
3 3/4	7.20	7.83	2.66	8.84	7.00	8.70	8.37
3 7/8	7.95	8.64	2.94	9.74	7.71	9.60	9.24
4	8.74	9.50	3.23	10.7	8.48	10.6	10.1
4 1/8	9.57	10.4	3.54	11.7	9.30	11.6	11.1
4 1/4	10.5	11.4	3.87	12.8	10.2	12.7	12.1
4 3/8	11.4	12.4	4.22	13.9	11.1	13.8	13.3
4 1/2	12.4	13.5	4.60	15.3	12.1	15.1	14.4
4 5/8	13.5	14.7	4.99	16.6	13.1	16.4	15.7
4 3/4	14.6	15.9	5.41	17.9	14.2	17.7	17.0
4 7/8	15.8	17.2	5.84	19.4	15.3	19.1	18.3
5	17.1	18.5	6.30	20.9	16.6	20.6	19.8
5 1/8	18.4	19.9	6.78	22.5	17.8	22.2	21.3
5 1/4	19.8	21.5	7.30	24.2	19.2	23.9	22.9
5 3/8	21.2	23.0	7.83	25.9	20.6	25.6	24.6
5 1/2	22.8	24.7	8.40	27.9	22.0	27.5	26.4
5 5/8	24.3	26.2	8.98	29.8	23.6	29.4	28.2
5 3/4	26.0	28.2	9.60	31.8	25.2	31.4	30.2
5 7/8	27.6	30.0	10.2	33.9	26.8	33.4	32.2
6	29.7	32.0	10.9	36.1	28.6	35.6	34.3
6 1/8	31.4	34.1	11.6	38.4	30.5	37.9	36.5
6 1/4	33.2	36.2	12.3	40.8	32.3	40.2	38.7
6 3/8	35.4	38.4	13.1	43.2	34.3	42.6	41.1
6 1/2	37.4	40.7	13.8	45.8	36.4	45.2	43.5
6 5/8	39.7	43.1	14.7	48.7	38.6	48.0	46.2
6 3/4	42.0	45.7	15.5	51.5	40.8	50.8	48.9
6 7/8	44.4	48.2	16.4	54.4	43.1	53.6	51.6
7	46.8	50.9	17.3	57.3	45.4	56.5	54.5
7 1/8	49.4	53.7	18.3	60.5	48.0	59.6	57.4
7 1/4	52.0	56.5	19.2	63.7	50.5	62.8	60.5
7 3/8	54.8	59.6	20.2	67.1	53.1	66.2	63.8
7 1/2	57.5	62.6	21.3	70.5	56.0	69.5	67.0
7 5/8	60.6	65.8	22.4	74.1	58.8	73.1	70.4
7 3/4	63.5	69.0	23.4	77.7	61.5	76.6	73.7
7 7/8	66.6	72.4	24.6	81.5	64.6	80.4	78.5
8	70.0	76.0	25.8	85.7	68.0	84.5	81.4
8 1/8	73.2	79.6	27.1	89.8	71.1	88.5	85.1
8 1/4	76.7	83.4	28.4	94.0	74.5	92.6	89.2
8 3/8	80.0	87.0	29.6	98.0	77.8	96.6	93.1
8 1/2	83.7	91.0	31.0	103	81.4	101	97.5
8 5/8	87.5	95.0	32.4	107	85.0	106	102
8 3/4	91.5	99.5	33.8	113	88.8	111	106
8 7/8	95.5	104	35.3	118	92.5	116	111
9	99.5	108	36.8	122	96.5	120	115
9 1/8	104	113	38.3	127	100	125	120
9 1/4	108	117	39.8	133	105	131	125
9 3/8	112	122	41.5	138	109	136	130
9 1/2	117	127	43.2	144	114	142	136
9 5/8	122	132	45.0	149	118	147	141
9 3/4	127	138	46.8	155	123	153	147
9 7/8	131	143	48.5	161	127	159	153
10	136	148	50.4	167	132	165	159
10 1/8	141	154	52.4	173	137	171	164
10 1/4	147	159	54.3	180	142	178	170
10 3/8	152	165	56.2	186	148	184	177
10 1/2	158	172	58.3	194	153	191	184
10 5/8	164	178	60.4	201	159	198	190
10 3/4	170	184	63.0	209	165	206	197
10 7/8	175	191	64.8	215	170	212	204
11	182	197	67.0	223	176	220	211
11 1/8	188	204	69.5	231	182	228	218
11 1/4	195	212	71.9	239	189	236	226
11 3/8	201	218	74.3	246	196	243	234
11 1/2	208	226	76.6	256	202	252	241
11 5/8	216	234	79.5	264	208	260	250
11 3/4	221	240	81.5	272	215	268	257
11 7/8	228	248	84.3	280	222	276	266
12	236	256	87.0	289	229	285	274
12 1/4	251	273	92.6	307	243	303	292
12 1/2	267	287	98.5	323	259	319	307
12 3/4	283	308	105	347	274	342	328
13	300	326	111	367	291	362	348
13 1/4	315	344	117	388	308	383	369
13 1/2	335	364	124	411	326	405	390
13 3/4	355	386	131	435	344	429	413
14	374	407	138	458	363	452	435
14 1/4	395	429	146	484	383	477	459
14 1/2	416	452	154	509	404	502	484
14 3/4	438	476	162	538	425	530	509
15	460	500	170	564	447	556	535
15 1/4	484	525	179	592	470	584	562
15 1/2	507	552	188	623	493	614	590
15 3/4	534	580	197	654	518	645	620
16	560	609	207	686	543	676	650
16 1/4	586	636	217	717	568	707	681
16 1/2	613	666	226	751	595	740	712
16 3/4	641	696	237	786	622	775	745
17	670	729	248	822	650	810	780
17 1/4	700	760	259	858	681	846	815
17 1/2	732	795	270	897	710	884	850
17 3/4	764	829	282	935	741	922	887
18	795	864	294	974	772	960	924
18 1/4	830	901	307	1,018	806	1,001	965
18 1/2	864	938	320	1,058	839	1,044	1,002
18 3/4	900	977	332	1,102	873	1,088	1,045
19	936	1,018	346	1,149	909	1,130	1,088
19 1/4	974	1,058	360	1,190	945	1,178	1,130
19 1/2	1,012	1,100	375	1,240	983	1,224	1,178
19 3/4	1,051	1,142	389	1,290	1,021	1,270	1,220
20	1,091	1,188	404	1,340	1,060	1,320	1,270
20 1/2	1,178	1,278	435	1,441	1,140	1,420	1,368
21	1,262	1,371	467	1,549	1,225	1,525	1,467
21 1/2	1,360	1,475	503	1,665	1,318	1,641	1,580
22	1,453	1,580	538	1,781	1,411	1,758	1,690
22 1/2	1,555	1,689	575	1,908	1,509	1,880	1,810
23	1,662	1,808	614	2,040	1,611	2,005	1,930
23 1/2	1,770	1,920	654	2,166	1,718	2,140	2,054
24	1,885	2,048	696	2,310	1,828	2,280	2,188

WEIGHT OF BALLS OR SPHERES

By W. L. Tryon

THE FOUNDRY DATA SHEET, SEPTEMBER, 1915

Payment will be made for all contributions on foundry and pattern shop practice suitable for publication

Note—This sheet may be cut into two sections, 5 x 7 inches, and may be readily bound in note-book form.

Molding and Casting Large Tunnel Segments

By the Use of Special Flask Equipment and Molding Machines the Cost of Production Was Greatly Reduced

By Louis J. Josten

IN the construction of the new subway tunnels under the East River, New York, a large number of heavy cast iron rings are used for lining purposes. They have an outside diameter of 17½ feet and are cast in segments, which when bolted together form the complete ring. The castings are being made at the plant of the Wheeling Mold & Foundry Co., Wheeling, W. Va. Two kinds of rings are provided, straight and taper. The straight rings are used under ordinary conditions, the taper or wedge-shaped rings being employed only where there is a change of line or grade introducing horizontal or vertical curves. At such points, the ring, taken as a whole, must be wider on one side than on the other in order to carry the tunnel around the curve. Furthermore two kinds of tapers are demanded, symmetrical and non-symmetrical. In the latter case all of the taper is carried on one side of the ring, the other side or face being square with the axis of the tunnel. In the symmetrical rings, the taper is divided equally between the two faces. In Fig. 10 a diagrammatic sketch of a section of the tunnel is presented showing the application of the different types of rings.

In addition, for convenience in construction, two methods of making taper rings have been adopted. In one case the taper is effected by changing the thickness of the flanges of the segments, while in the other case the width of the web between the two flanges is altered. The segments weigh from 242½ to 1516½ pounds each.

It is clear from the foregoing that the foundry handling this work is confronted with the problem of making a very large number of heavy castings, many of which differ slightly from the others in both size and shape. Financial considerations, however, demand that the investment in flasks and special rigging be kept at a minimum. This article describes the flask equipment and rigging used by the Wheeling Mold & Foundry Co. and points out how the same apparatus is adapted to the manufacture of both straight and taper ring tunnel segments of various dimensions. The taper rings are made in three sizes with ¾-inch, 1½-inch and 2¼-inch tapers, meaning that the ring has the same width as a standard, straight ring on one side, the width on the other side being increased by ¾ inch, 1½ inches or 2¼ inches, as the case may be. The metal patterns, core boxes, etc., used in this work are all adjustable. The flasks, including the follow and bottom boards, are made about three inches wider than is necessary for molding the regular straight segments. This additional width permits the same flask to be used for molding both the regular and the widest special segment for a 2¼-inch taper ring.

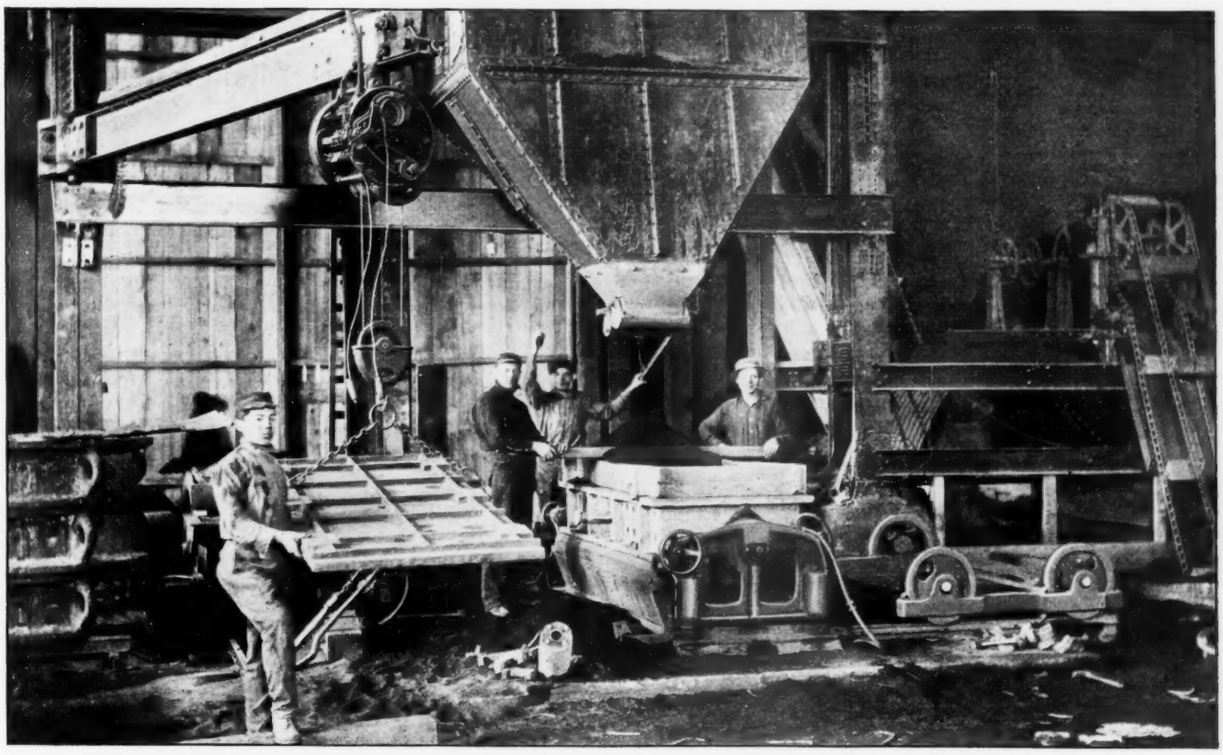


FIG. 6—OSBORN DIRECT DRAW ROLL-OVER JOLT MACHINE USED FOR MOLDING TUNNEL SEGMENTS

Figs. 1 and 2 show respectively the details of the copes and drags used by the Wheeling company for this work. It will be noted that the drag is of standard construction and that it will be suitable for ordinary work after the tunnel ring contract is completed. This type of flask is preferred to a curved flask, inasmuch as the latter is suitable

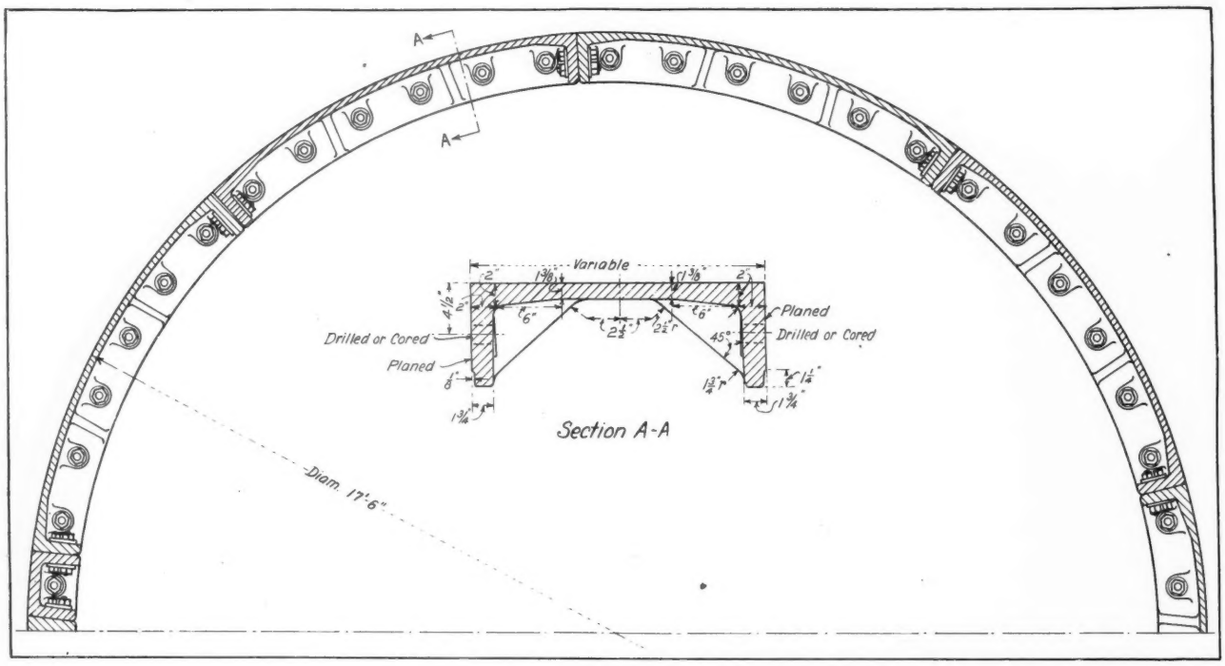


FIG. 7—HALF SECTION OF A TAPER RING

only for the special work for which it is designed. As indicated in Fig. 2 both faces of the drag are planed to a smooth surface so that the drag will fit properly with the bottom board and cope.

The follow boards are shown in Figs. 3 and 4, the cope board being illustrated in Fig. 3 and the drag board in Fig. 4. The cope board is provided with an adjustable runner guide and the drag board with an adjustable gate. The gates are attached to the circumferential flange as indicated in Fig. 9. They permit the metal to flow freely into the mold without splashing and eliminate the danger of shot iron in the castings. In order that the gates may be properly centered on the flange the gate patterns are provided with an adjustment of 1⅛ inches. This adjustment also makes it possible to use the same follow board for all kinds of straight and taper segments. The runner guides on the cope board also are provided with a 1⅛-inch adjustment.

Each side of the drag board is provided with two slotted pins which are so placed that they line up properly with the holes in the drag flasks. The slots in the pins receive taper wedges which are used in connection with clamps to hold the flask securely to the follow board. The convex and concave surfaces in the cope and drag follow boards are constructed to a radius equal to half the diameter of the outside of the tunnel ring. All parts of the boards are made with a liberal draft so that the sand will not tear when the flasks are removed. The surfaces marked *f* in Figs. 1 to 4 have been machine finished. The riser plug, which is made of metal tapering from 2½ inches down to 1 inch in diameter, fits onto the middle of the convex surface of the cope board. Both cope and drag boards are metal and are cored out wherever possible to reduce the weight; sufficient metal section, however, are provided to afford a liberal margin of strength.

The details of the adjusting mechanism for the runner guides and gates on the cope and drag follow boards are shown in Fig. 5. All of the parts are cast iron except the cope runner guide plates which are made of steel in order to resist wear. The adjusting mechanism fits into slots cored in the main flange of the follow board. The cover plates are of such a size that the openings are covered at all times, in order to protect the screw threads and operating rods from sand. When properly adjusted the mechanism is locked by the set screw S, Fig. 5.

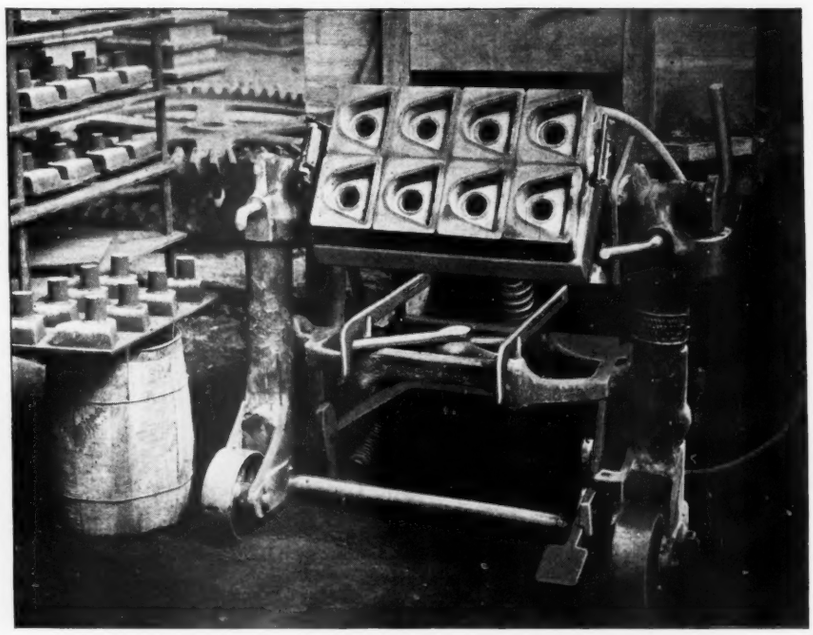


FIG. 8—PLAIN ROLL-OVER MACHINE USED FOR MAKING CORES

The molds are made on a direct draw roll-over jolt machine furnished by the Osborn Mfg. C,o. Cleveland. Fig. 6 shows the machine in operation, one of the

finished molds being shown in Fig. 9. When the mold is finished and rolled over it is deposited on the truck shown on the right of the machine, from which it is removed by a crane. The sand is handled, cut and mixed mechanically, the prepared sand being stored in a steel bin situated immediately over the molding machine. The bin is fitted with a hopper bottom terminating in gates with which the flow of the sand may be controlled. One of the bottom boards is shown suspended from the crane at the left in Fig. 6.

The service of the molding machine has been entirely satisfactory. The machine has been in constant operation for over seven months during which time it has struck approximately 1,500,000 10-ton blows with a 3-inch stroke without requiring any attention beyond an occasional adjustment. In order to obtain a maximum jarring effect, the bottom board is securely fastened to the roll-over table and the flask in turn is fastened to the follow board. Care is taken to make the bottom board used on the drag flask of sufficient thickness to prevent the mold from sagging in the flask.

The machine shown in Fig. 6 is used for molding drags exclusively, the copes being molded on a plain jolt machine. The cores for the taper segments are made on an Osborn direct draw roll-over machine as indicated in Fig. 8. Eight cores are made on the machine at the same time, the core boxes being of metal. Each core box is provided with a master core print which is machined to exact dimensions. The box is ¼-inch larger than the core print, babbitt being used to fill the space. This construction practically eliminates the fin which forms around the outside of the bolt holes when the casting is poured.

Hard Iron

By W. J. Keep

Question:—We shipped recently a number of fly wheels, but our customer advises us that these were too hard to machine. The metal analyzed as follows: Silicon, 2.59 per cent; sulphur, 0.058 per cent; manganese, 0.55 per cent; combined carbon, 0.66 per cent, and phosphorus, about 0.60 per cent. We would like to know why this iron was not satisfactory for machinery. The percentage of combined carbon undoubtedly is rather high, while the manganese is a little low. Do you think that the high combined carbon and the low manganese would produce this hardness and if so, which would have the most effect in hardening the metal, the manganese or the carbon?

Answer:—Manganese always hardens, but up to 1 per cent its influence is not sufficiently marked to be noticeable;

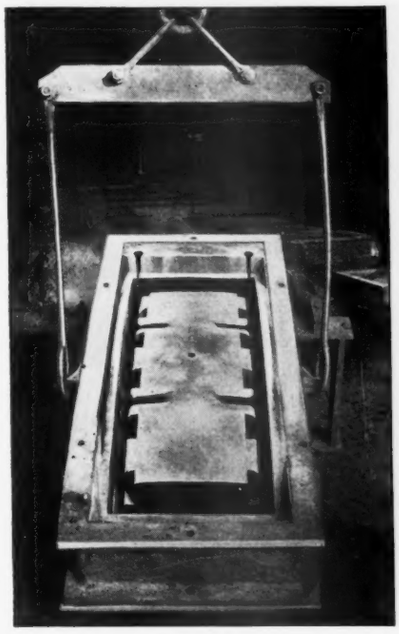


FIG. 9—FINISHED DRAG MOLD

0.55 per cent is about as low as manganese can be carried in iron. Aside from the combined carbon, the analysis is ideal. However, the combined carbon is not sufficiently high to prevent machining and, therefore, the trouble is not with the iron mixture or its chemical composition. I do not think that the iron was hard and it might have been possible for you to turn a wheel in a lathe and ascertain for yourself whether it would not be satisfactory to machine. In my book entitled "Cast Iron" I state that the rate of cooling and the manipulation of the iron before it enters the mold exerts nearly as much, if not more, influence on the resulting casting than the chemical composition. I also proved satisfactorily, I believe, that pig iron could not be made into castings according to precise scientific rules. The reason that it is possible to score so many successes in the foundry business is due largely to the fact that no close lines are drawn in slight chemical variations which show no great discrepancy in quality. Keeping the cupola scaffold clean, the scrap small, the charges uniform, exercising care in molding and gating, maintaining the proper temperature of the iron when pouring into molds, using a proper quality of molding sand, etc., are all physical propositions which will overbalance any slight changes in chemical composition. For these reasons, I advocate, as a measure of quality, the shrinkage of the metal. High shrinkage indicates hardness, but an increase of silicon will lower shrinkage and soften the casting. Any foreman can apply this test. Unless a foundryman is sufficiently well versed in the application of chemical analysis, it might be more advisable for him to place this part of the work in charge of an experienced chemist.

The percentage of combined carbon is the result of varying conditions in the metal and, therefore, the amount indicates that there is reason for it. This may be attributed to the physical conditions which can be varied, and considered from the chemical standpoint, it is well known that varying silicon will vary combined carbon and these variations are accompanied by changes in shrinkage and hardness.

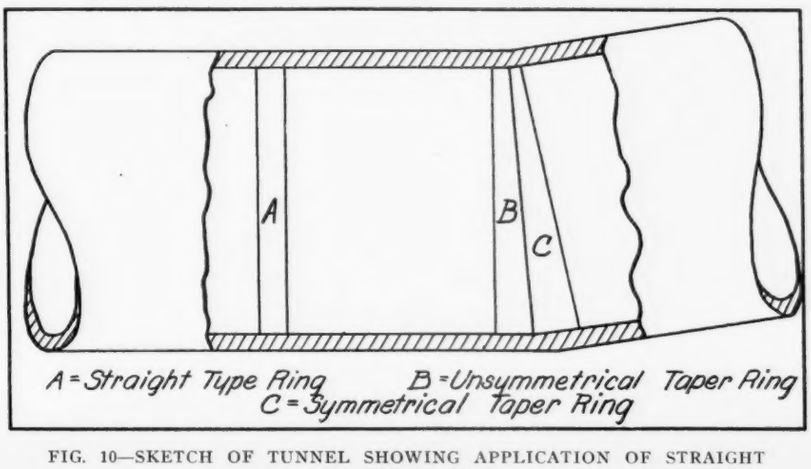


FIG. 10—SKETCH OF TUNNEL SHOWING APPLICATION OF STRAIGHT AND TAPER RINGS

The Ajax Sand Co., Erie, Pa., has been incorporated with $10,000 capital to engage in the mining and shipping of molding and silica sand for foundry operations. Banks are located at Greenville and Oil City, Pa. The latter part is now producing 400 tons of silica sand per day, which is largely being shipped to the steel-casting trade. The officers of the company follow: W. L. Scott, president and general sales manager; T. B. Ely, treasurer, and F. H. Flowers, secretary.

Efficiency in the Plating Room

By E P Later

ALMOST anyone can run a plating room, after a fashion, but to conduct it in accordance with the principles of modern business, to obtain the desired results with the least expenditure of time and money, requires a high degree of executive and technical ability. The old-time shop, poorly lighted, with few conveniences and little regard for ease and efficiency in handling the work, is no more; there is no longer a place for it. Now we let machinery do the heavy work and that which must be left to the hands is done in the easiest and quickest way possible. As a result the workman is able to do more; better work is performed with far less effort and time and everybody concerned is happier.

This does not mean, of course, that perfection in these lines has been reached, for this is by no means true. There is great room for improvement in many lines and this seems to be especially true in the case of electroplating.

In many ways the study and practice of efficiency in a plating room is different from that in a machine shop or foundry. While the basic principles of both are perhaps the same their application may present certain difficulties peculiar to the particular line under investigation. And so with electro-plating, efficiency depends on so many factors, physical and chemical, that anything like a thorough discussion of it would assume the proportions of a book. In this article, therefore, an attempt will be made to point out some of the principles governing its application; the detailed working out of these must necessarily be left largely to each foreman and superintendent.

Perhaps some of the readers of this paper have at some time found themselves in the position of a certain concern, which came to the writer's attention not so very long ago. It had been running a job machine shop and plating room for many years and through honest service and good will had built up a profitable business, especially in the plating end. Several years ago, however, the receipts from this department began to fall off materially and each succeeding year saw the net profit grow smaller. There was plenty of work, but competition was keen and prices had to be cut to what, for this firm, was rock bottom and with wages and the cost of materials increasing rather than otherwise, the *picking*, as the saying goes, was getting pretty slim.

Finally the situation became desperate; a fairly heavy year ended in a slight deficit for the plating room. The old foreman, who had started as a boy and grown up with the company, declared he was doing all in his power and could suggest no remedy. As a result the management had practically decided to give up the plating business entirely, when a bright, young fellow, trained both in the theory and practice of plating and in the application of efficiency principles, learned the state of affairs and called on the manager.

At first the latter was not interested and almost unapproachable, but at last thawed out a little under some well-founded arguments and agreed to let the young fellow *nose around*, as he put it, and see what he could do. His salary was to be strictly proportional to those last four words.

The young expert set to work and in three or four days had a good grasp of the situation. In the first place, he found that the old man who was running, or trying to run, the plating room, prided himself on the fact that he was a *practical* man. In this case, as in most others of this sort, it meant that he could do a fair day's work with his hands, but his ignorance of the improvements which have been made in the art during the last

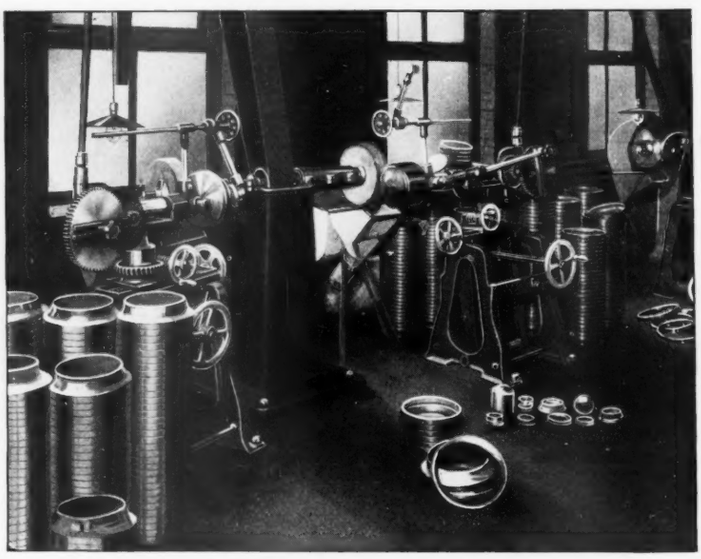


FIG. 1—AUTOMATIC BUFFING MACHINES, BUILT BY THE AUTOMATIC BUFFING MACHINE CO., BUFFALO

30 years or so was colossal. The old fashioned way was good enough for him, so he used the same equipment, the same old methods that had been installed 40 years before. To make matters worse he had a lot of old men working for him, old-time platers, each of whom had ideas equally as ancient as the foreman's. The result was, each followed out his own notions as much as possible, and chaos reigned, as far as definite, standard methods were concerned.

In the grinding room cheap wheels of every degree of fineness and hardness were used, without any regard for the character of the part being ground, and the spindles were run at an equally great variety of speeds. Consequently, some wheels were speeded up until they did

plenished or dumped out whenever the helpers felt like it, so they were never twice alike, aside from the fact that such a procedure entails the loss of both time and material. As far as the plating solutions were concerned, nothing ever was known definitely about their composition or condition. For example, when the foreman wished to determine if the nickel solution was up to strength he noticed the depth of color by sticking his hand in it and if his hand showed up brighter than he considered proper he added what he thought was the right amount of nickel salts.

The effect which a dark day or a dirty hand would have on this test may be easily imagined. About on a par with this was his habit of con-

not soldered and their resistance was very high, as a direct test with instruments showed a surprisingly large drop in voltage between the dynamo and the rods of some of the tanks. Now, it takes a good deal of power to overcome such a series of resistances, so it is not to be wondered at that the machine was overloaded. In the last analysis it simmered down to the fact that they were buying current at a high price and wasting a large part of it in various ways, instead of getting it to the tank where it could do useful work.

Perhaps the least said about the voltmeters and ammeters, the better. Certainly the needle in one or two of them would not have moved for anything less than a lightning flash and none of them would register anywhere near

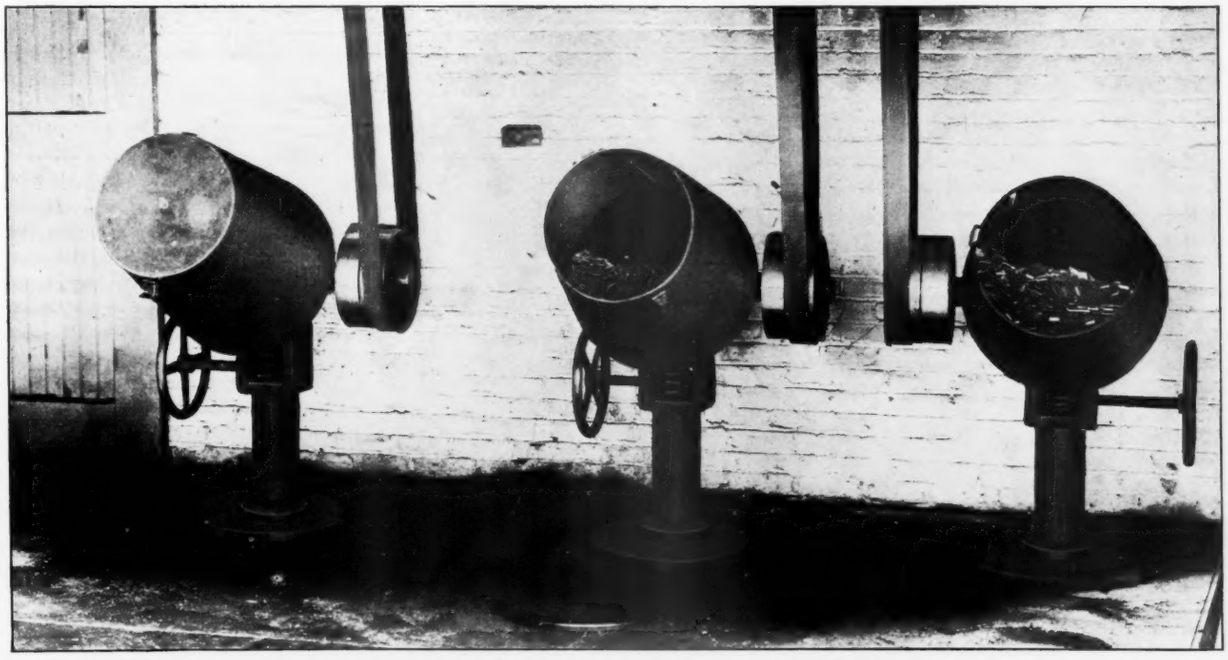


FIG. 2—TUMBLING BARRELS, BUILT BY GLOBE MACHINE & STAMPING CO., CLEVELAND

little more than glaze the work, without giving a good, clean cut, while others revolved too slowly and cut accordingly.

About the same conditions obtained in the buffing room. The wheels were not running at the proper speeds and several kinds of cheap buffing compounds were used; some of the work was scratched and cut through, while other parts required altogether too much buffing to produce a good color, since the compound used was deficient in abrasive qualities. Also, no attempt was made at routing the work, hence it was all dumped indiscriminately together and frequent sorting and rehandling caused the loss of much time.

In the plating room proper there was even greater lack of system. The cleaning and dipping solutions were re-

tinually tinkering with the solutions. He was always adding a pinch of this or a handful of that to them, doping them until not even he knew what they contained nor how they would work. Further, the anodes in all of the tanks needed cleaning badly and made poor contact with the anode rods, which also were stained and discolored. Altogether, less than one-half of the anodes were making sufficient contact to let an appreciable amount of current through.

The Generator

As regards equipment, the generator was of fairly recent design, but had been rather carelessly looked after and was heavily overloaded. The busbars and conductors were likewise too small and heated noticeably, but the greatest defects were in the joints. These were

accurately anything as weak as a plating current. In other words, they were not in good repair, therefore were useless. But no one looked at them anyway.

The general arrangement of the plant was very bad. The plating tanks and dipping and cleaning solutions were placed apparently at random and with no attempt at convenience. As a result, the men spent a large part of their time and strength carrying the parts up and down, back and forth, getting in each other's way and causing too much waste motion generally. Lastly, the ventilation was decidedly poor. The air was steamy and damp, filled with acid vapors, cyanide fumes and so on, making it more than disagreeable to work in. It will probably seem to the reader that this plating room possessed about

every possible fault and so it seemed to the expert. And, in truth, it was an old, run-down place, with old methods, crude equipment and poor management. After he had finished his examination he drew up a long report showing the exact conditions he had found, together with his plans for their solution, and submitted it to the manager. It was drastic and involved considerable expense but covered the situation thoroughly and, figuring from the amount and class of work which was being finished at that time, the expert assured him that the changes which he proposed would enable him to make a profit that nearly floored him.

The management considered the plans carefully for several days, visited a number of other plating establishments and saw some of these plans in actual operation, and finally told him to go ahead. They had no desire to lose a good plating business if it could be done at any kind of a profit.

Constructive Criticism

Criticism, to be helpful, must be constructive and since the conditions found in this place are often duplicated to a greater or less degree in other establishments, perhaps a discussion of the changes introduced may be of assistance to some of the readers of THE FOUNDRY who may be called upon to put new life into an old business and enable it to meet modern, high-speed competition.

The first change related to the personnel of the plating department, involving the elimination of some of the deadwood and the introduction of new brains, with fresh, practical ideas. And right here a snag was encountered. Uncle Billy, the foreman, was nearly 70 years old and the manager flatly refused, and rightly, too, to turn him out after he had spent the best years of his life working faithfully, if narrow-mindedly, for the firm. At the same time it was realized that all hope of a successful re-organization depended largely on his retirement, since he was too old to grasp and carry out new principles in the right way. Finally the idea of a pension was broached and when it was referred to him the old fellow accepted it gladly, to the relief of everyone. One other old man was pensioned also and it may be remarked here that the company made money in both instances by so doing, since they were practically worthless as workmen and sheer humanity forbade their being discharged. A new foreman, well grounded in theory and with years of practical experience behind him was hired and the work of installing new machinery and methods began at once. Starting in the grinding room, the old wheels were replaced by a standard brand and, from data obtained from the manufacturers and by experiment, these were driven at their most effective speeds. This change was not at all expensive, since it involved only the shifting of a few pulleys, but the results were easily noticeable. Also, efforts were made to see that the texture of the wheel was suited to the character of the work being ground, that is, hard, rough parts require a different sort of wheel from smooth parts, perhaps made from a softer metal. Of course, in a job shop it is not always possible to obtain the very best conditions in all of these things, but the more nearly they can be obtained the higher will be the efficiency.

Finally, substantial guards were placed on all of the emery grinders, thus reducing the possibility of injury from a broken wheel to the minimum. On examining the parts which were

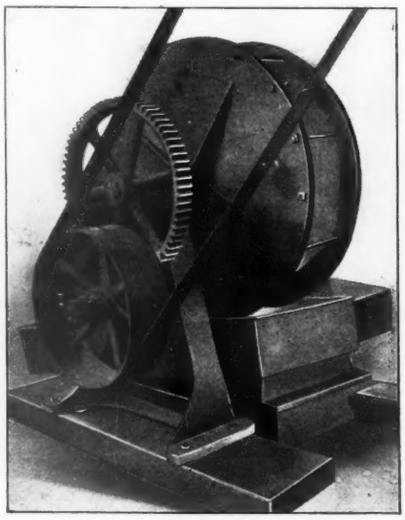


FIG. 3—BALL BURNISHING BARREL

being handled, the expert had found that a good many of them were of such character that they could be buffed easily on an automatic buffing machine. Accordingly, they installed a machine similar to that shown in Fig. 1 and its performance was a revelation to some of those who were acquainted only with the old, hand method of buffing. The parts were turned out in jig time, beautifully finished, with astonishing ease and rapidity, and a very substantial saving was at once effected. Naturally, many parts do not admit of being finished in this manner and some hand buffing had to be done, accordingly several changes were made which put the operation on a better footing. They consisted in proper regulation of the speed and in the adoption of several well-known and reliable buffing compounds, for use on different classes of work. A slight rearrangement of some of the machines also made it possible to route and handle the work to much better advantage.

Lastly, a good ventilating system, including dust hoods, was installed, thus giving the men purer air to breathe. No man can do a real day's work when he is forced to breathe a peck of dust and lint into his lungs in eight or ten hours.

It also may be worthy of note that cleaning the windows and applying a liberal coat of whitewash to the walls and ceiling brightened up the whole place amazingly and actually made it easier to do more and better work.

Plating Room Changes

As might be expected, it was in the plating room that the greatest changes were made. First, the equipment was overhauled. The dynamo was put in good shape and the switchboard thoroughly cleaned, after which the wiring was gone over and every joint taken apart, cleaned and carefully soldered. Certain of the mains were really too small to carry the loads put upon them so auxiliary cables were run to help them out. The old rheostats were repaired and put in proper shape by cleaning or replacing the contacts and so on; some which were too far gone were junked. The old voltmeters and ammeters, too, were looked over and as most of them were hopelessly antiquated and corroded they were replaced by modern instruments, accurate yet rugged and designed for the severe service of a plating room.

Two or three of the old tanks were in such wretched shape, rotten and leaky, that it was economy to discard them and get new and larger ones in their place. All cathode and anode rods were removed and cleaned, anodes and anode hooks were scoured and, what is equally important, strict orders were given to keep them in that condition. After all this had been done direct tests showed that the resistance of the various circuits was only a small part of what it had been before. In other words, almost all of the energy of the dynamo was available for performing useful work, instead of being used up in overcoming the resistance of a lot of poor connections. So much for the old equipment.

The expert had noted, with surprise, that no use was made of rotoplaters, although a large amount of small parts were finished, by laboriously stringing them on wires or racks and plating them in still tanks. Accordingly a machine was set up and everything that could be handled at all conveniently was plated in it. As a consequence, the

plating costs of these parts were considerably below their former mark. An analysis had showed the plating solutions to be mostly a mixture of a variety of things and working at very low efficiency. Several were so low in metal content that they were dumped in the sewer, as the best way of getting rid of them; the others were taken out of the tanks and stored in barrels, to be used up gradually. The tanks were then cleaned out and new solutions made up on the basis of formulas which experience has shown to be correct in every way. A bright lad, with a high-school knowledge of chemistry and a desire to learn the plating business, was hired to keep the solution in working order. A few simple pieces of apparatus were purchased and by a little coaching the boy was able to determine the exact composition of each solution in a very short time. He made regular, routine tests each day, calculating from his results the amount of new material to be added and sent the report to the foreman, who would then direct that the additions be made. In this way the foreman was in direct charge of the solutions, knew their composition with great certainty, and knew what was being done to maintain them, yet very little of his time was required for this. On the other hand, the boy cost only a few dollars a week, but kept everything in perfect shape so there was never any doubt as to how the solutions would work, no spoiled work and no time lost while somebody experimented and doped, trying, by some lucky chance, to hit upon the thing that was lacking or to correct an unfavorable condition.

This inspection also extended to the dipping and cleaning solutions and daily tests of these were made. Thus it is easy to keep them always of the right strength and waste of material is prevented; when they become loaded with impurities to the point where it is not economical to replenish them, they are dumped out and fresh solutions made.

Chemical Analysis of Supplies

In the matter of supplies, too, chemical examination proved itself of much value in this case, as it always does. In place of accepting whatever the dealer sent in and paying him his price for it, as formerly, it is now specified in the order that the material shall be of a certain grade, that is, contain a certain percentage of active material as, copper, nickel, cyanide and so on. Examination of some of the stock on hand showed that the nickel salts were markedly deficient in nickel and there was abundant evidence that in the effort to purchase the cheapest possible material, in an effort to reduce costs, the firm was actually losing money, since it did not even get its money's worth. Now, every shipment of material is tested and accepted only if it comes up to standard. The tests are made by the boy who has charge of the solutions, consequently cost very little, while they are of great value in many ways. Further, the markets are closely watched and any fluctuations in price are taken advantage of; also, by purchasing in as large quantities as practicable additional concessions are often obtained, so it is safe to say that the company buys good materials at the lowest possible price.

As to the general arrangement of the rooms, several changes were made to give greater facility in performing the finishing processes. This re-arrangement did not cost much and consisted mainly in locating the cleaning tanks where they would be most accessible to the greatest number of plating solutions, and so on. Also, as in the case of the grinding and buffing room, a system of ventilating fans was installed and the air kept much purer.

Remarkable Change Effected

Altogether at a far less cost than might be supposed, this plating room was changed from a ramshackle, haphazard affair, that hardly paid running expenses and turned out a very mediocre grade of work, into an up-to-date establishment that pays good wages, is healthful to work in, sends out beautiful work and returns a satisfying dividend.

Now, this case has been gone into at some length, not because this plating room is perfect, for it is far from being that, nor because there is anything especially remarkable in the changes made, but merely to illustrate some of the principles involved in the application of modern methods to an establishment which needs them. Most, if not all, of the alterations which were made would apply to any plating room, but it is not always possible, of course, to handle all cases alike. Roughly, efficiency means getting the most for your money, no matter whether that money is paid out in wages or tied up in equipment or spent for supplies. Conditions differ greatly in different plants. One may be well managed and efficient in all but one or two particulars, which may be the cause of considerable loss; another may need a general overhauling, as in the case just considered. It also happens sometimes that a plant is trying to do work for which it is not properly equipped. Such a case came up not long ago. The owner of a small plating outfit was getting into pretty deep water, financially, trying to finish large, bulky parts to the exclusion of the small work. He had an idea there was more money in the former, but he overlooked the fact that a little of it was enough to fill up his small tanks, so he could not handle enough of it at one time to make any profit, especially since prices had been cut very close by competition. On the other hand he was able, by the use of rotoplaters, to handle small parts to advantage, although he did not realize it and was very indifferent about accepting them for finishing. Finally he confided his troubles to a friend and on going over the situation the above state of affairs came to light. After a good deal of argument the friend succeeded in convincing him that he could make a greater profit on small work so, as soon as he could, he started out after it and has been making money ever since. Of course, this may have been an odd case, not characteristic of the business as a whole and it may be asked why he did not hold out for a higher price for his work. The answer is easy: he simply could not get it. He was competing with other plating establishments which had enough room and equipment to handle bulky parts profitably at a price which meant starvation for him. Now he keeps his rotoplaters busy and wears the smile that won't come off.

While, strictly, this may be outside of the province of this article, the above incident calls to mind the fact that a careful survey of the situation will sometimes reveal that the local market offers greater inducements along some lines than others, also that the equipment available is better suited to certain classes of work. Ordinarily, at least, the owner of a plating establishment should not merely try to get any kind of work: he should endeavor to obtain that which he can do to the best advantage. There is no profit in simply keeping busy. Naturally, it is not always easy to take your pick of the work in this manner, but often a good deal can be done by skillful catering toward working into those lines which mean the largest profit.

Study of Local Market

Further, in investigating a plating room from the standpoint of efficiency the character of the work handled must be taken into consideration. A plant doing a large variety of jobbing work is obviously under very different conditions from one operated by a factory, since in the latter case the kind and approximate amount of work to be finished is definitely known and time and labor-saving devices may be installed with direct reference to the specific conditions to be met, while in

the other case the improvements and changes must often be of a more general nature. And it must not be forgotten, of course, that the size of the plant makes a good deal of difference, as a large one, for example, could afford to install expensive machinery and institute methods of controlling the various factors which would be out of the question with the little fellow, with his two or three or half-dozen tanks. Altogether, it will be easily appreciated that all of the devices and suggestions contained herein may not be applicable in every case.

Minor Details Important

Some of the general means of conserving energy, both human and electrical, such as reducing the resistance of the apparatus and circuits, maintaining a definite control over the cleaning and plating solutions, operating the grinding and buffing wheels at the proper speeds and so on have been given in the discussion of the plating room referred to in the first part of this article. Before considering some of the other devices which make for efficiency, however, the writer wishes to emphasize again the importance of looking after the points which are often thought to be of little or no importance. What good does it do to have automatic buffers and all such appliances if the time and money which they save are lost in other ways? So, proper control of the solutions is very important, as the production of a good deposit in the minimum time is directly dependent upon it. The necessity of using good materials of known composition and of having the proper arrangements for easily and conveniently handling the work should not require further discussion.

As to the mechanical devices for speeding up the output, there are several of these on the market which are worthy of attention. Perhaps the most familiar is the rotoplater.

This consists essentially of a fairly large tank containing a solution of the metal to be plated, the anodes being suspended along the sides. The parts to be finished are placed in a perforated cylinder which revolves in the solution, driven at a low rate of speed, five to ten revolutions per minute. In some machines the cylinder is made of wood, but in others it is formed by stretching heavy canvas over a light, wooden framework, which is perhaps a better arrangement.

When a large number of small parts are to be finished, this sort of machine furnishes a quick and easy means of doing it. Stringing such parts on wires is slow and expensive and plating in baskets does not always give satisfactory results, while only comparatively small quantities can be handled. A rotoplater, however, can accommodate a large number of parts and the constant rolling and friction to which they are subjected produces a more or less hard and polished surface, while the deposit is generally very uniform.

Certain classes of parts, especially those which are fragile or easily bent, may not be adapted to such a method of finishing, but in the great majority of cases it can be used to decided advantage. In practice, some means is provided for quickly raising and emptying the cylinder or replacing it by another. Ordinarily this takes the form of a small air hoist or similar device.

Frequently, when very small parts or only moderate quantities of larger parts are to be finished a barrel plater may be used to advantage. It is similar to a tumbling barrel, shown in Fig. 2, and is little more than a cask supported on a base in such a manner that it can be rotated freely and provided with suitable anode and cathode connections, the latter simply being a metal plate fastened to the bottom of the barrel and grounded on the framework, while the anode may be allowed to dip into the solution, suspended by a heavy conductor. Such a plater requires but a small amount of floor space and power, but is capable of finishing quite a large variety of work. As in the case of the other rotoplater, the tumbling action hardens and polishes the surface. Altogether, it may often be used advantageously, especially on the little odds and ends of work which are otherwise troublesome.

Ball Burnishing Barrel

Passing now to the cleaning and polishing operations which are performed before or after the plating, parts are frequently rusty, oily or sandy and to prepare them properly for finishing is quite a task, for a nice, bright appearance is desired on parts that have been plated or dipped. The machine shown in Fig. 2 will conveniently take care of all such cases. It will be noted, that in this particular type, which is built by the Globe Machine & Stamping Co., Cleveland, the barrel is made of steel and is revolved by a simple system of gearing. A worm gear, worked by a hand wheel, tilts the barrel to any desired degree, to accommodate the rapidity of tumbling to the particular class of work being treated and to discharge the contents.

The exact working conditions vary according to the circumstances. For instance, if the parts are simply rusty or dirty, tumbling with sawdust, either dry or slightly moistened, as may be needed, will clean them at a small cost for power and almost no attention. In the case of plated parts or others in which it is desired to brighten up the finish, tumbling with leather meal will accomplish this end nicely. Sometimes it is necessary to remove a considerable amount of rust and cut down the surface of parts; then tumbling with sand is resorted to, a slightly different shaped barrel, horizontal and more like the cylindrical rotoplater, being used. The length of time required for any of these tumbling operations varies considerably and may range from one to ten hours or longer. Thus one man can attend to several machines and handle a large number of parts with ease.

Burnishing With Steel Balls

Along slightly different lines, the process of burnishing with steel balls has come into some prominence during the last few years and is finding more or less extensive use in the finishing of a large variety of parts. A widely used type of machine is shown in Fig. 3, which represents one built by the Abbott Ball Co. In performing this operation, the parts are placed in the barrel together with twice their volume of hardened steel balls. Water and a small amount of soap chips, with a bit of cyanide, is then poured in and rotation started. Under the rubbing action of the balls, the surface of the parts is hardened and smoothed down, a very good finish being produced. As will be appreciated, this process is not intended nor adapted to remove any metal from the parts, therefore, they should be reasonably smooth before tumbling. The length of time required will naturally depend on the general condition of the work and will range from one to five hours, as a general thing, a softer metal receiving the finish in less time than a hard one. Different sizes of balls are used, according to the size and condition of the work to be treated.

Almost every plating room, especially one connected with a manufacturing plant, has a large amount of small work which must be given some sort of finish, but which is very expensive to handle, by buffing and so on in the old, piece-by-piece style. In most cases of this kind the tumbling process just described will provide a cheap and easy way of giving the parts a finish which is often surprisingly good. Practically the only expense connected with it is the cost of power, as the materials and attention amount to very little. A barrel can be loaded in a few minutes and then will take care of itself for several hours, when it is just as easily unloaded.

Brief reference has already been made to the automatic buffing machine and a short description of it will not be out

of place. As will be noted from Fig. 1, it is a right and left hand machine which is attached to an ordinary buffing lathe, one to each wheel, the necessary power being supplied through a steel shaft connected to the countershaft. The parts are held in a suitable chuck which revolves slowly and can also be given a reciprocating motion, if necessary, to bring all parts of the surface in contact with the buffing wheels. In operation, the tender chucks one part, which is buffed while he is chucking another so that no time is lost, and a good workman can turn out several times as much work as by the old, hand method, which requires a considerable degree of skill.

Naturally, it will not handle every kind of irregular and intricate piece and generally has to be adjusted for each particular class of parts, but when a reasonably large amount of each has to be buffed it will prove useful.

In conclusion, efficiency in the plating room means little more than doing the work in the best and quickest way, the elimination, as far as possible, of all waste of time, materials and energy in all its forms and the maintenance of a definite control over every solution and process, so that all uncertainties of their action are removed, as far as may be, and uniform results may be depended upon.

Charcoal as Cupola Fuel

In the August number of THE FOUNDRY, page 303, an inquiry was published regarding the possibilities of employing charcoal for fuel in melting iron in a cupola in place of coke. One foundryman recently conducted a test to ascertain the utility of charcoal for this purpose, but the experiment, unfortunately, proved unsuccessful. Charcoal constituted the last two fuel charges and it was the intention, if the test proved satisfactory, to charge the charcoal on the last three charges, then the last four, and so on, until the entire heat would be melted with this fuel. On the second last charge, 60 per cent more charcoal than coke was charged and no difficulty was experienced in having the fuel blown out of the stack. However, when the iron was charged onto the charcoal it immediately caught fire and began to burn so strongly that the charging program was changed and coke was added on the last charge in place of charcoal, as previously intended. The fact that the iron from the last two charges was dull and came fast would indicate that all of the charcoal was burned out before the iron reached the melting zone. Therefore, it was concluded that it would be unsafe to carry the experiments further, as it is evident that charcoal cannot be used satisfactorily for melting iron in a cupola if it is employed in a manner similar to coke.

Discussion by Dr. Richard Moldenke

Unfortunately, the test was not made in accordance with the demands of this particular fuel, the blast was not reduced, the charges were not cut down, the bed was not lowered, nor was anything done to get CO_2 instead of CO and to insure the melting at the proper point. Therefore, the charcoal merely burned up. I think charcoal is too expensive in any event as a fuel for cupola operations.

The Surface of Molten Cast Iron

By Robert A. Pitman

How many readers of THE FOUNDRY have had an opportunity to look upon the naked surface of molten cast iron at rest and undisturbed? I venture to say that the number is very small indeed, as the coating of oxide which forms instantly upon the exposure of molten iron to the oxygen of the atmosphere, prevents one from seeing the actual surface of the metal except momentarily, through the cracks in this coating of oxide, which does not give much of an opportunity to study the surface.

Recently, while engaged in experimental work with cast iron, an opportunity occured which enabled the writer to look upon the surface of molten cast iron undisturbed and unobstructed by any coating of oxide.

It happened in this way. We were making a casting 6 inches in diameter, standing on its end, and through the top of the mold projected the end of a core-print, about 4 inches in diameter. The core was metal and was to be withdrawn from the casting quickly after the pouring, before shrinkage had set in and gripped it. As we had no apparatus prepared for the purpose of drawing the core, the writer concluded to draw it by hand, and for this purpose, took a position on top of the mold during the pouring.

At the first trial, the core was withdrawn too soon, with the result that the iron in the mold, not having set, naturally dropped back to its level when the core was withdrawn. Inasmuch as the core print was quite deep, the drawing of the core, acting like a pump, caused the space to be filled with air and gases which were drawn through the joints of the mold, and in close contact with the very hot metal, so that these gases and air were so rarified, as to contain too little oxygen to act upon the surface of the molten metal. Hence, when the core was completely withdrawn, the surface of the metal was exposed to view, without its customary coating of oxide. In appearance, it was a bright, golden yellow, and through the core print opening was to be seen an absolutely perfect reflection of everything above the surface of the metal. The details of one's face, and even the details of the roof construction overhead, were as clearly reflected as in a mirror.

While the unusual spectacle was being watched with great interest, a small cloudy spot began to form in the rarified air in the core print. This cloudy spot began to rotate slowly and passed a little further into the mold with each rotation, until it passed completely through the print, into the space over the molten metal. As it approached the surface, the iron, which had so brightly reflected the light, was covered in an instant with a coating of oxide.

The whole performance occupied approximately six seconds, and the feeling of disappointment, when the oxygen reached the metal and clouded it, was keen, although it was felt that an opportunity had been given, which was rarely enjoyed by any one.

Qualifications Contradictory?

To the Editor:—The August issue of THE FOUNDRY contains an article by E. A. Johnson, on the Wentworth Institute and its work in training young men to become experts in the foundry business. Mr. Johnson says that many foundry proprietors are forced to continue operating their plants by old and antiquated methods, because it is impossible to find men with the necessary training in up-to-date foundry practice to run their shops. How are we to reconcile this statement with the columns in the advertising section of THE FOUNDRY headed "Positions Wanted". Here we find each month dozens of foundrymen advertising for positions, men trained apparently in every conceivable branch of the foundry business. This is a matter of considerable interest to me and possibly to others who may be contemplating the study of foundry work and I would be grateful indeed for some light on these two seemingly contradictory points. Possibly a superabundance of modesty, a disposition to hide their light under a bushel, may have prevented some of these applicants for foundry honors from connecting with positions commensurate with their ability. For instance, an advertiser who in addition to all the other virtues supposed to be inherent in the up-to-date foundryman, announces himself as possessed of "ability, energy, common sense, courage and nerve". Rather a formidable combination and one which might readily cause the foundry proprietor with peaceful tendencies to steer clear of an applicant giving such a militant description of himself. —L. I. K.

A Few of the First Principles of Shop Planning

Scientific Management and Its Application to a Government Foundry is Discussed, With Sidelights on Its Operation

By F M Perkins, Lieut., U. S. N.

IN THE past few years great strides have been made in the industrial world in the art of management or, as the more popular term has it, scientific management.

Many books and countless magazine articles have been written upon this subject. Some have strongly advocated scientific management; others have as strongly denounced it. Still others, without seeming to care whether their own particular brand of management could be characterized as scientific or unscientific, have gone calmly on their way occasionally offering the result of their experiences to the industrial world in a quiet and constructively helpful manner.

The result is that the subject of management has been studied, discussed and written upon from every viewpoint. You may turn to the book shelf in your office and select a book giving you the psychological effect upon the workman of pleasant surroundings or from another book you may find the forms for a follow-up system with dimensions of the cards carefully given to the eighth of an inch, and other details as minute. The result of all this is that the knowledge of management has increased remarkably within a comparatively few years. At the same time the general idea of what constitutes efficient management is yet somewhat hazy. Ideas are not yet completely crystallized upon the subject. We have gone through that first stage where scientific management was popularly supposed to be something like a pill, to be taken at once with immediate, beneficial effect. We have found that scientific management is not a cure-all, that its applicability and suitability vary under different conditions. We have discovered that scientific management, although capable of producing remarkable results, is not in itself particularly remarkable; that instead of being something mysterious and revolutionary it is really nothing more than common sense systematized and uniformly applied.

We have learned that there is really something in this scientific management, but that the vital part of it does not necessarily consist of the outward and visible forms. Just because the manager's office is filled with fancy follow-up boards, routing sheets, high-speed reversible, double-acting time cards, work charts, etc., it is not necessarily true that his management is scientific. By *scientific* I wish to be understood as meaning efficient, for, as applied to management, the terms are almost synonymous. If the management is not truly efficient, it is certainly not scientific. These forms of management are in themselves about the least important part of management; they may be regarded as necessary evils to be kept at a minimum. In descriptions of systems of management greater stress is often laid upon the shape, size and arrangement of some form or chart, than upon the necessity for the form, the work done by it and the saving made by its use. These forms frequently are revealed to us as something extremely remarkable in themselves while, as a matter of fact, with a pencil, a piece of paper, a straight-edge and a knowledge of the information to be carried on the

FIG. 1—THE SHOP PLANNING DEPARTMENT OF THE PUGET SOUND NAVY YARD

form one may, within an hour, design half a dozen forms for the same purpose, all about equally good.

Therefore, in endeavoring to increase our knowledge of management and our own ability as managers by actual experience and by observing, conversing, and reading we should devote our greatest effort toward gaining a clear understanding of the principles upon which good management is founded, for with these principles well understood we are equipped to build the form or structure of the management of our own business with greater skill than one unfamiliar with its details.

It is far from the purpose of the writer to attempt anything so ambitious as a general discussion of the principles of good management. It is the purpose of this article to discuss only one of the elements of good management; namely, planning, the necessity for it, the extent to which it should be carried and the practical benefits to be gained with special reference to the particular case of planning for the pattern shop and foundry.

In any system of management the most vital element is the planning of the work. It matters not how simple the work to be done may be; it matters not whether the shop be large or small, or, indeed, whether a shop exists or not. All forms of human activity must be and are preceded by either conscious or subconscious mental processes which plan the thing to be done. The simplest acts we perform our minds involuntarily plan for us. We breathe without being conscious of it, we are barely conscious of the act of drinking a glass of water; eating requires a slightly greater mental effort; carving a roast is a more complicated matter and demands more effort of the mind to determine how it may best be done; preparing a dinner demands much more mental effort-planning than carving a roast; managing a large hotel is a still further complicated matter necessitating not only the mental efforts of the manager, but also the mental efforts of his heads of departments; all of this is planning—from the simplest act of our lives then, to the most complex, everything is planned. The simplest acts such as breathing and walking our minds plan involuntarily, automatically; the complex, interwoven combination of acts required to conduct the work of a large manufacturing plant necessitate a planning staff employing the efforts of a number of minds. Between these two extremes of human activity is every degree of simple and complex activity and for each degree there is a method of planning best adapted to that form. How are we to select the method of planning best suited to our individual needs?

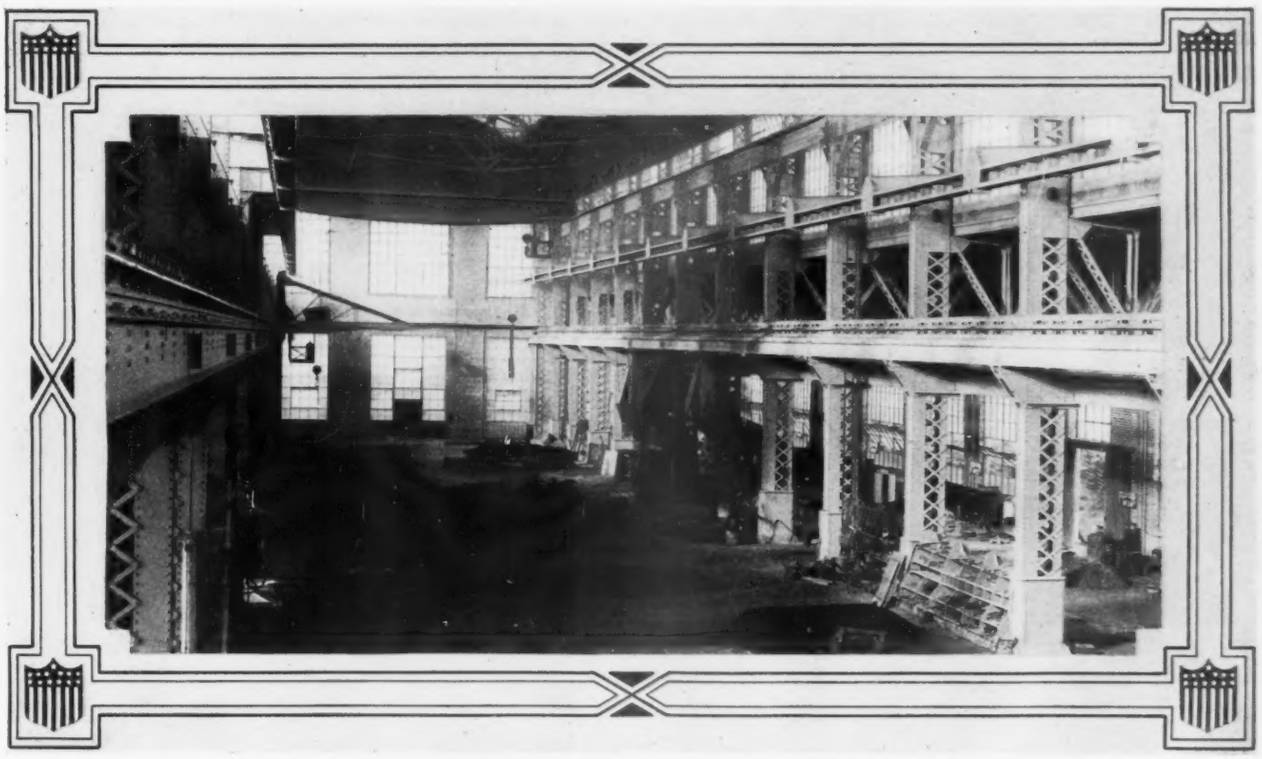


FIG. 2—THE MAIN BAY OF THE PUGET SOUND FOUNDRY

Planning Elements of Foundry Work

Pounding dirt in a flask seems a very simple proposition. So it is, but there is a pattern inside that flask which must draw; it must not be broken by ramming; that *dirt* must be a molding sand of the proper grade for the work and properly tempered; it must not be rammed too hard; it must not be rammed too soft; it must be rammed hard in one place and soft in another; it must be finished in time for pouring-off. Pounding sand in a hole begins to lose its simplicity. The casting must be delivered to the machine shop in time to be machined and fitted to place in the piece of machinery to which it belongs and which is to be delivered at 2:00 p. m., next Saturday. The casting is only a little thing, but the machinery will be unable to operate without it. The little casting itself is worth only a dollar; the machine to which it belongs is worth $1,000 and there is a penalty if we do not deliver it on time. That man busily pounding dirt in a little box over in the corner of the foundry is a rather important being after all. How does he know that he must have that casting finished this afternoon in order that a $1,000 job may be delivered at 2:00 p. m. next Saturday? He doesn't. It was planned for him. He has nothing to think of but the business for which he is trained—molding. There are a lot of other things about that little casting that he doesn't know. He doesn't know why it was designed to that peculiar shape, nor why it has just so much strength at this particular section, nor how the patternmaker *happened* to finish the pattern just an hour or two before he commenced the mold.

nor why it was cast in a certain kind of metal which will be inspected and must come within an allowance of a very few hundredths of 1 per cent of a given chemical composition.

Our molder friend was only one of a large number who at one time or another have been or will be interested in our little casting and the casting itself is only one of hundreds to be turned out daily, each one of which must travel regularly on its way from the time when it exists only as a few lines on a blue-print until it reaches the shipping room, a finished article ready for use. All this is made possible by planning; with no planning at all, utter chaos would result; with efficient planning the various steps are co-ordinated and move regularly and without interference toward the production of the completed product.

What are the fundamental principles upon which we may base a system of planning which will produce a smooth, uniform flow of work for the least amount of effort in the planning department?

In the first place we have said that all forms of human activity must be and *are* planned before they can be accomplished. Therefore, for a given result we know that a certain amount of mental effort must be expended. Therefore, we may rest assured that when we issue an order to do a certain job that, if we furnish no plans for the job somebody else must and will do the planning necessary to do the work. The job may be so simple that the mere issuing of the order to do the work is all that should be given and the man who does the work plans it in his own head without delay.

In dealing with such a case it is obviously useless and wasteful to attempt to furnish a detailed plan. The planning of such a simple job is part of the trade of the man performing it; mechanics are paid for their heads as well as hands; use should be made of both.

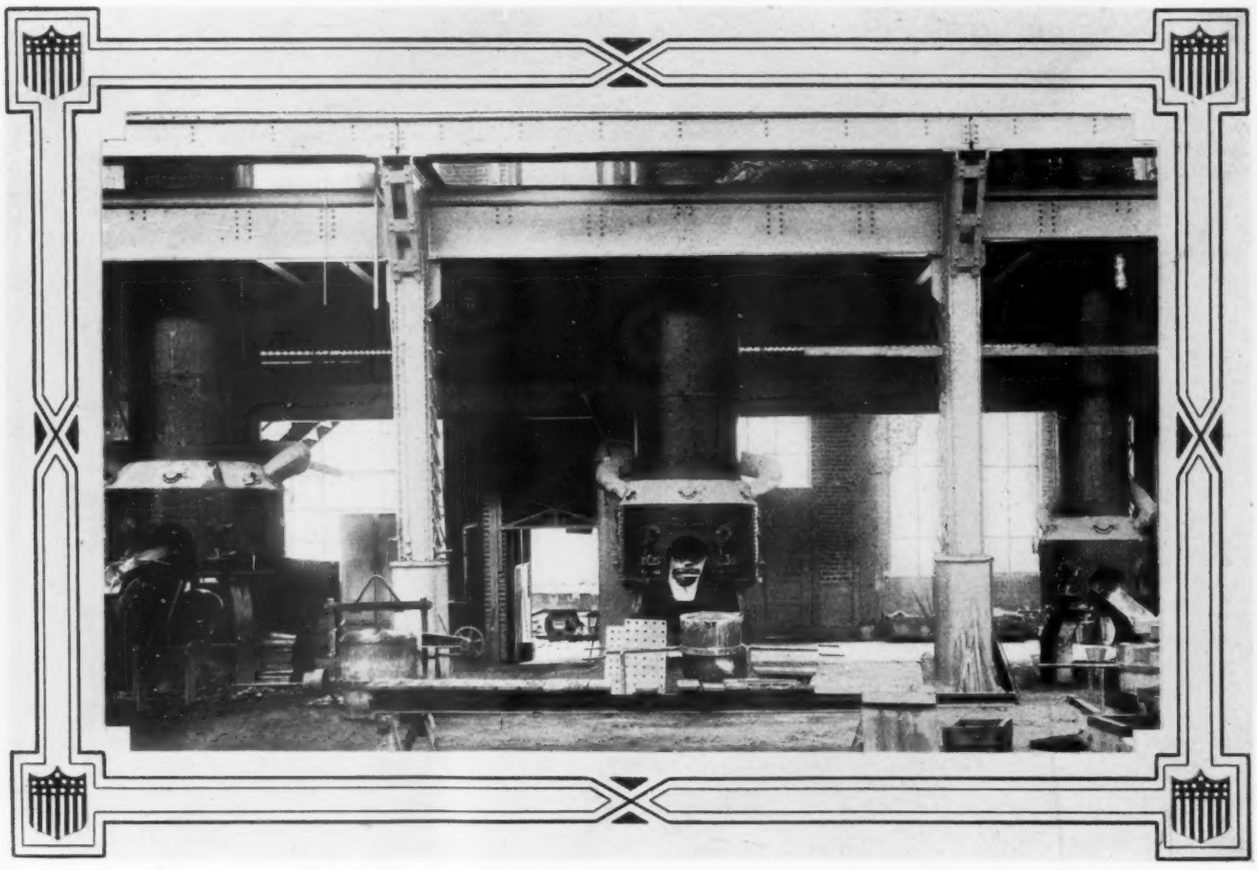


FIG. 3—THE CUPOLA ROOM OF THE PUGET SOUND FOUNDRY

It should again be emphasized that planning does not mean the issuance of instructions in such detail as to rob the workman of initiative and of the necessity for using his mind. Planning that deprives the employer of the use of the mind of the employe is wasteful. True planning commences where the mind of the individual employe stops. True planning is concerned with only such individual instructions as may be necessary. Without restricting individual initiative true planning has for its object the standardization, co-ordination and direction of the efforts of individuals and departments and the production of a harmonious system whereby interference and loss of time are avoided. True planning does not exist simply for the sake of planning; it exists only so long as it positively and profitably facilitates the execution of the work. True planning is simple and tends constantly to further simplify itself. It tends to produce system and order and a standard method of management and operation. When, as a result of planning, certain elements of the management become automatic, they are adopted as routine and planning for that particular element ceases.

There is a practical lesson to be learned from our consideration of the fact that every piece of work done must be and is planned before it can possibly be completed. The lesson is this: If that work is not planned before it is undertaken it must be planned as it progresses; if it is not planned by someone specially detailed to the work of planning it must be planned by the men who do the work. We may send unplanned work into the shop and imagine that we are saving overhead expense in the office, but the planning must be done. We have only given the planning to somebody else, probably someone not particularly well qualified for it or someone whose time should be wholly concerned with production and not with planning. The cost of the planning

simply covered up so as not to offend the eye when looking over the monthly expense account; it actually exists in a more agreeable form in the productive labor account.

To carry on any given piece of work, four elements are necessary:

1.—The man.
2.—The material.
3.—The tools.
4.—The instructions.

It is the function of shop planning to bring these four elements together for every individual job at the proper time and place.

These four elements are the means which the planner must use to assign the work to the best advantage. All four elements must be assembled before work can be done; the man is helpless if he lacks either material, tools or instructions and obviously the latter three elements are useless without the man. To insure that every one of dozens, hundreds, or thousands of jobs performed daily shall not be delayed by the tardiness or lack of any one of these four elements is certainly a great undertaking. This is the function of planning. It produces order and system, until as active, actual planning it becomes unnecessary, yet continues to exist in the shop practice as routine.

The main consideration affecting the job, in so far as the man is concerned is that he shall, if possible, be the best available man for the work. He should be a specialist if possible, or to state it differently, as far as possible every job should be assigned to the man best qualified to perform it. This statement may sound like an attempt to expound the obvious, yet kindly bear with it for a moment and apply these questions to your own business:

1.—Do you know what class of work every man in your plant is best qualified to perform?

2.—Did you gain this information (a) by asking the foreman; (b) by asking the man; (c) by assuming that the man is qualified for this class of work simply because he has always done this particular kind of work in your plant; or (d) did you give the man an opportunity to work at several different classes of work and keep records or make close observations to determine the class for which he is best suited?

3.—Assuming that your knowledge of the men's individual qualifications is correct, have you a sure and systematic way of making use of it? In other words, does *every* job, so far as possible, and as a matter of routine, go to the man best qualified to execute it or is it only the special work, the hard jobs that receive this attention?

FIG. 4—THE BRASS MELTING DEPARTMENT OF THE PUGET SOUND NAVY YARD'S FOUNDRY

Material

In the case of the second element, material, the principal point with which planning is concerned is to see that the material for each job is supplied to the man upon or before the completion of the preceding job. In the case of foundry work, the patterns and cores may be considered as the material. It is advisable to supply the pattern or material well in advance of the current job and to place it where it can be seen by the workman, who, as he works, consciously or unconsciously considers the ways and means of working upon the material provided for the next job. This reduces loss of time between jobs. The planner must see that cores are ordered sufficiently in advance to prevent delay in clamping up after the mold is finished, and provide for other similar needs. In the absence of instructions from higher authority it becomes the function of the planner to see that the standard material or, without standards, to insure that the best material for the job is provided. The next point is to see that no waste can occur due to providing more material than necessary.

With regard to tools, planning is concerned with seeing that the proper tools are used for each job. The foundry planner is concerned less with this point than is the planner for the machine shop. Jobs which belong on the floor or bench should not be made on the machine. Small jobs which may be well adapted to machine molding may often be more economically performed on the

FIG. 5—A NEAT CORE STORAGE SIMPLIFIES THE ROUTING OF CORES TO THE MOLDING FLOORS. THE MOLD-DRYING OVEN AND STEEL CONVERTER ARE SHOWN AT THE RIGHT

floor or bench when the cost of mounting patterns for the machine is considered. This is a point constantly requiring the judgment of the planner. The work of the foundry planner may properly include the provision of flasks and his work should be supplemented in the foundry by the convenient location of other accessories required in the work.

The fourth element, instructions, demands the careful attention of the planner to insure that the information is complete and his good judgment to avoid loss of his own and others' time by making them verbose or unnecessarily detailed. In the case of pattern shop and foundry work, the instructions will naturally affect the pattern shop to a greater extent than they do the foundry. Instructions should be clear and concise; they should enable the workman to

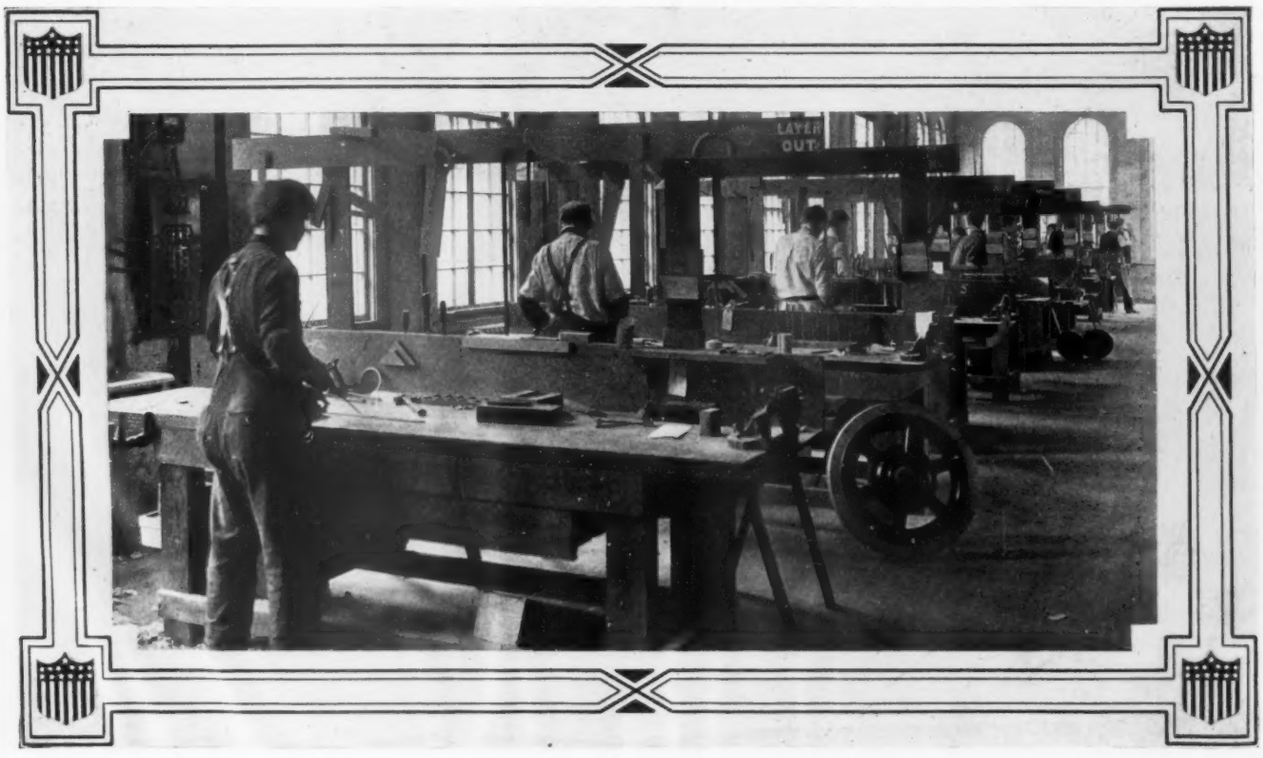


FIG. 6—THE BENCH DIVISION OF THE PATTERN SHOP

picture to himself the finished work. The criterion should be as they leave the planner, "Will these instructions permit the workman to proceed at once with the job without questions or delay?" "Do they contain information with which he is not concerned?"

Instructions will take the form of a drawing, a sample, written verbal instructions or oral instructions. It is in connection with this element of planning that the beneficial work of a good planning system will be felt the most, particularly in the case of jobbing shops, repair plants, ship building plants and other plants not manufacturing standard articles, for in plants of this kind incomplete instructions are the most fruitful source of delay.

The four foregoing elements of planning, men, material, tools and instructions, are necessary to execute the various individual jobs. To co-ordinate these individual jobs and to assemble the various parts at the proper time and place planning must take account of the disposition of the individual outputs. The planner must know what results are wanted as regards disposition and must have a simple, effective means of routing to make use of the transportation system.

Installing a Planning System

When installing or perfecting a system of planning the manager should keep the fact constantly in mind that planning, merely for the sake of planning, must not exist. Planning exists only for the purpose of securing certain results; when some of these results can be obtained as a matter of routine, they need not be placed under the control of the planning department. When a certain feature or operation has been planned until a routine or standard method has been adopted, that operation may be dropped from the control of the planning department and a reduction made in the department or its efforts devoted toward standardizing some other operation or feature of the management.

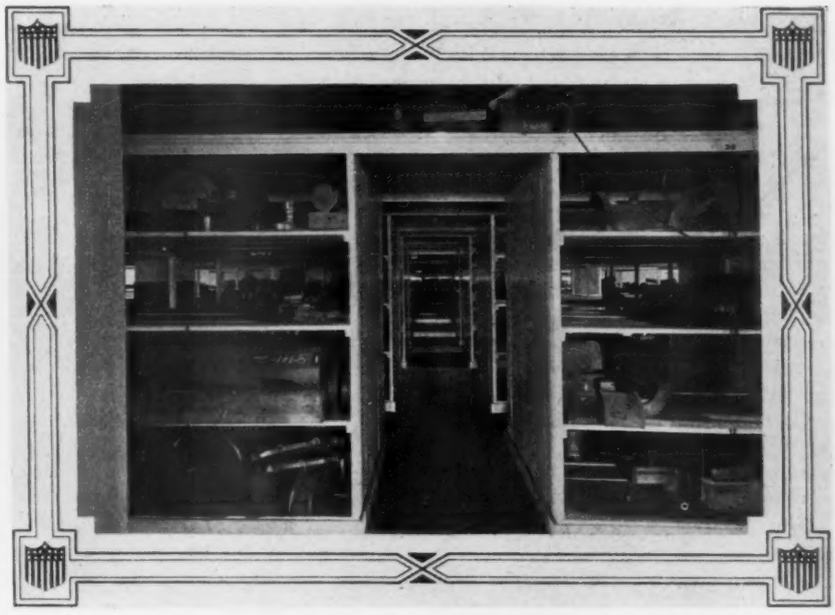


FIG. 8—A SECTION OF THE ORDERLY PATTERN LOFT

The size of the planning department does not depend so much upon the number of men employed as upon the class of work done. Highly specialized manufacturing work is readily standardized and capable of systemization to the point where practically everything is reduced to routine. In this case the *results* of planning are obtained, but they are obtained *automatically* and not by separate, detached, unsystematic effort.

In jobbing shops, large repair plants, ship building plants, etc., a separate planning department is necessary, but it should constantly strive to reduce its functions to a routine and to approximate the conditions obtained in the highly specialized manufacturing plant.

The results to be obtained being kept clearly in mind, every effort should be made toward simplifying and systematizing the means of effecting them.

Navy Yard Planning Office

The accompanying illustrations of the pattern shop and the new general foundry at the Puget Sound navy yard, Bremerton, Wash., illustrate in a measure the effect of shop planning upon shop arrangement.

The planning office, Fig. 1, handles the work of several other shops in addition to the pattern shop and foundry. The work of this office includes not only the planning, but also a small standardization section whose function is the collection, recording and filing of data referring to works' operations. These data are used to simplify and expedite the planning.

Fig. 6 shows a section of the pattern shop with benches arranged for easy routing and supervision of the work.

Fig. 8 illustrates a portion of the pattern loft which is on two floors directly over the pattern shop and is connected with it by elevator service. More than 30,000 patterns are stored in this loft. A pattern storage card index is kept which makes it possible to obtain any desired pattern upon two or three minutes' notice. The index card for each pattern shows its number and the number of separate parts, core boxes, size of

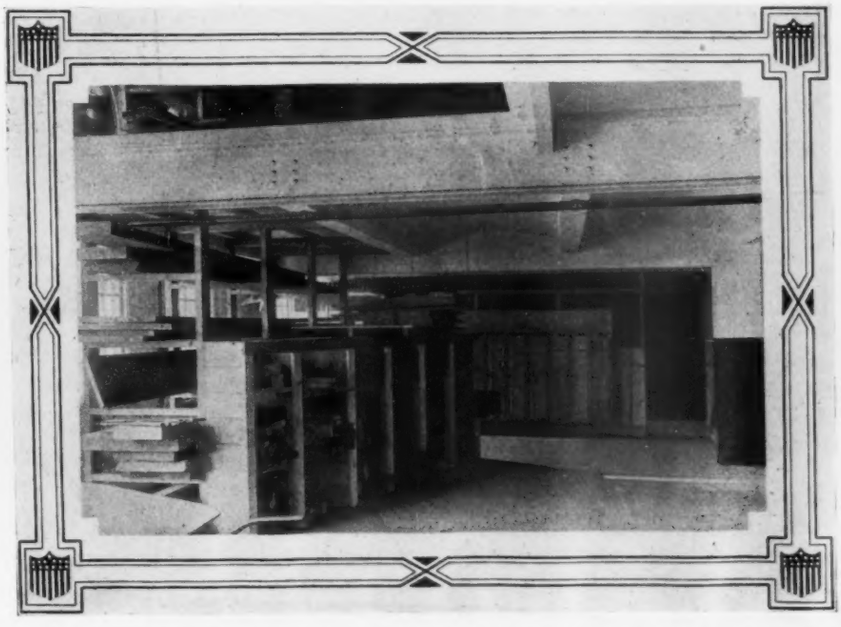


FIG. 7—SHORT ENDS OF PATTERN LUMBER ARE STORED CONVENIENTLY AND ACCESSIBLY

flask needed, dates and nature of changes in pattern, drawing number from which made and a sketch giving the principal dimensions of the pattern.

The foundry is a modern building of steel, brick and glass construction, approximately 110 feet wide by 300 feet long. It is well heated, lighted and ventilated and is divided by building columns into two side bays, and one center or main bay, Fig. 2, extending the full length of the shop. One side bay contains the brass department, while the main bay is for gray iron and steel. The other side bay is divided by the cupola room, Fig. 3. On one side of the cupola room are the core room, core ovens and steel converter, Fig. 5, and on the other, the blower and cleaning rooms. The main bay is served by one 40-ton and one 20-ton, 50-foot span bridge crane and by two 5-ton traveling wall cranes. The brass department in the north bay has a 3½-ton, 30-foot span bridge crane and the cleaning room has a 5-ton, 30-foot span, bridge crane. All cranes are operated by means of alternating current motors.

Melting Equipment

The melting equipment consists of three Colliau cupolas, lined to 48, 36 and 24-inch, one 1,800-pound Whiting side-blow converter, three Hawley-Schwartz oil-burning tilting furnaces of 4,000, 1,000 and 500 pounds capacity, Fig. 4, and two small, Monarch tilting crucible furnaces of 150 pounds capacity each.

In addition to the usual equipment, the core room is supplied with core-making machines, core-jarring machine, sand mixer and wire straightener. Cores are baked in two large core ovens whose cars run into the core room, and one small sheet metal oven, all coke-fired. A mold drying oven also is installed in the core room.

The cleaning room contains the usual equipment of tumblers and grinders, a 36-inch, motor-driven cold saw, drill press, and magnetic separator.

To facilitate the assignment of work and delivery of patterns, flasks and cores, the total molding space is divided into individual floors or sections, each having its own number. These include machine, bench and floor molding in gray iron, steel and brass.

A lunch and locker room, and a modern sanitary toilet and wash room with shower baths and individual wash bowls are provided in the foundry, while a number of sanitary drinking fountains are located on the molding floor.

PROBLEMS OF THE BRASS FOUNDER

What To Do and How To Do It

Dirt Spots in Brass Castings

We are making brass castings which must machine without a defect, but they frequently develop porous spots on the machined surfaces. We have tried the following mixtures, but the results in all cases have not been satisfactory:

Copper, 20 pounds; zinc, 8 pounds, and lead, 2½ pounds.

Copper, 30 pounds, and zinc, 15 pounds.

Copper, 65 pounds; zinc, 34 pounds, and lead, 1 pound.

We have used charcoal, borax and glass as a flux, but the trouble still persists.

The defects referred to undoubtedly are due to dirt, such as charcoal, sand or dross, rather than to porosity. The dirt has been deposited on the cope side of the casting at a point farthest from the gate, which would indicate that it is picked up as the metal enters the mold. Probably there are sharp corners at the juncture of the branch gates and runner, which allow the metal to carry off a few grains of sand and these are deposited in the casting. We suggest that all corners on the gate be waxed and well-rounded off. If it be possible to apply a skim gate on the mold, it would help materially in obtaining clean castings.

In pouring yellow brass it always is desirable to keep the sprue head full of metal while the mold is filling, to keep out the zinc oxide. The mold should never be allowed to draw air, as this produces more oxide, which is deposited on and adheres to the walls of the mold, resulting in defects in the casting.

We suggest the following yellow brass mixture, which is an improvement on the three mentioned:

Copper, 75 pounds; zinc, 21 pounds; tin, 2 pounds, and lead, 2 pounds.

Use 1 per cent of yellow prussiate of potash as a deoxidizer for yellow brass if porosity develops.

Die-Casting Mixtures

Will you give us information relative to an aluminum mixture satisfactory for castings made in dies under pressure?

The following alloy is excellent for casting in metal molds: Aluminum, 80 per cent; zinc, 15 per cent; tin, 2.5 per cent, and copper, 2.5 per cent.

The following is a regular die-casting formula: Zinc, 85 per cent; tin, 10 per cent; copper, 3 per cent, and aluminum, 2 per cent.

Plastic Bronze Analysis

If possible, we would like to obtain the analysis of plastic bronze.

The analysis of plastic bronze follows: Copper, 65 per cent; lead, 30 per cent, and tin, 5 per cent.

Improper Use of Red Brass Turnings

About a month ago we received an order for a bronze bushing, 14⅜ inches outside diameter, 13 inches inside diameter and 5 feet long. The weight was about 1,000 pounds. While the mixture was not specified, the requirements demanded a close-grained metal without imperfections, to be inspected rough-turned, and finished. We used about one-half red brass scrap and the balance consisted of good, red brass turnings, scrap copper and a small quantity of tin, lead and spelter. The first casting almost met the requirements, but to insure a more satisfactory bushing, we remelted the metal and made two other attempts, each of which was worse than the first. We then discarded this metal and made another mixture, which consisted of 500 pounds of red brass scrap, 700 pounds of copper and 40 pounds each of tin, lead and spelter. This casting was satisfactory. Both mixtures subsequently were analyzed and the first one which did not produce a satisfactory casting contained copper, 83.44 per cent; lead, 4.95 per cent; zinc, 6.48 per cent, and tin, 4.80 per cent. The mixture which gives good results analyzed as follows: Copper, 82.48 per cent; lead, 7.47 per cent; zinc, 6.11 per cent, and tin, 3.80 per cent. If possible, we would like to have you point out why the second mixture was satisfactory and why the first mixture was a failure?

The difficulty caused by the first mixture was due to the use of red

brass turnings. The metal may have been clean and of good quality, nevertheless it was in a finely divided state and thus exposed a large surface to oxidation.

You would have found it more advisable to have melted the turnings separately and to have used the red brass turning ingots in the casting mixture. When melting turnings of this kind, add from five to eight ounces of 15 per cent phosphor-copper to 100 pounds of the charge just previous to casting into ingots. The phosphorus will remove oxides which cause gas and porosity. Repeated melting of the alloy does not improve it, but on the other hand causes the deposit of an additional amount of oxide each time it is melted. When remelting such metal it is well to observe whether the surface of the metal in the furnace is mushy. If this is the case, add a small handful of common salt and stir it into the surface of the mushy metal. This will have the same effect as zinc chloride on aluminum and will clear the metal, after which add phosphor-copper, as previously directed. The composition of the alloy has nothing to do with the first failure, although the second mixture, owing to its higher lead content, is more liable to give a tough casting than the first.

Sand Suitable for Brass Work

I have been experiencing difficulty in obtaining a suitable sand for molding car brasses. I have been using sand with some clay as a binder, but the metal washes it away rapidly in the mold. The sand also burns onto the brass and does not peel properly. Kindly give me a suitable sand mixture for this class of work.

A molding sand suitable for casting car brasses should not be too fine, as otherwise trouble will be experienced from scabbing. Any foundry supply house can be depended upon to furnish such sand and we suggest a grade approximating No. 2 Albany. Artificial molding sands can be made by adding to free sand, preferably silica, a percentage of powdered clay, but the mixture should be well milled before it is used, to thoroughly incorporate the sand and the clay, otherwise they will not be sufficiently well mixed to withstand the cutting action of the metal and the sand will wash away, as stated. A natural molding sand seems to be the best medium for making castings. If the molds are dusted with flour, the sand will peel from the castings readily, although such a procedure is not followed in making such castings as car brasses.

Piping for Chill-Cast Bars

We are casting bars, about 3 feet long, in chilled iron molds, the mixture consisting of copper, 58 per cent; zinc, 40 per cent, and lead, 2 per cent. We are having some trouble in obtaining solid bars, as they frequently contain small holes that extend through the center from the top to the bottom. We do not believe that this is caused by dirt, as the cavities are bright and clean. We have poured shorter bars in sand molds and they have been solid. However, the sand method is too expensive for our purpose. The chill molds have 1-inch walls and are held together by clamps.

From the description of your difficulty it would seem that it is due to piping, in which case this might be overcome by the use of a dry sand head on the chill mold. This head can be made in the same way as a core and, in fact, is merely a round core with a funnel-shaped opening in its center. This is placed on the mold and is filled with the metal when the mold is cast. The metal in the mold will congeal before that in the riser and the metal in the latter will feed down into the mold and will insure sound castings. The secret of success in casting copper alloys in permanent molds is in the provision of the reserve of metal not exposed to the chilling influence of the rest of the mold, and which will remain liquid until the casting has set. The reserve liquid metal then feeds down by gravity in the vacant places formed in the casting by shrinkage. The holes then are in the riser and not in the casting. It should be remembered that since the density of alloys is increased by rapid cooling, they shrink more than slowly-cooled sand castings and, therefore, more provision should be made for feeding to prevent defects.

Overheating Aluminum

We are having trouble in making an aluminum casting which contains defects on the top or cope side. The mixture consists of 84 per cent aluminum and 16 per cent of hardener. The latter contains three parts of copper to one of aluminum.

Your difficulties undoubtedly can be attributed to overheating of the metal during the melting period. Aluminum has a strong affinity for oxygen and it will absorb it from almost any element, provided the temperature is sufficiently high. Therefore, it is important to keep the temperature below the point at which it will reduce and combine with either the constituents of the crucible or the fuel that may fall upon the surface of the metal. The temperature should never be permitted to exceed that of dull redness while melting and there is no necessity for a higher temperature inasmuch as the hardening is incorporated easily at a comparatively low temperature. Aluminum hardening usually consists of 50 per cent copper and 50 per cent aluminum. This alloy is used in the proportion of 16 pounds to 84 pounds of aluminum, thereby adding 8 per cent of copper to this metal. When the hardening is made with three parts copper, the content of the latter is higher than is generally employed for hardening purposes. Probably it will be found that the 8 per cent copper alloy is better from the casting standpoint than any other that is being used.

Genuine Babbitt Mixture

Will you kindly furnish me with a mixture for genuine babbitt? How do you mix arsenic with lead for babbitt and what grade of arsenic should be employed? Also kindly advise of what sal-ammoniac is made and whether it would be advisable to make it or buy it?

The composition of genuine babbitt varies with the purpose for which it is to be used. Usually, when *genuine* babbitt is specified, the following alloy is indicated: Tin, 88.8 per cent; antimony, 7.5 per cent, and copper, 3.7 per cent. When adding arsenic to lead, the metallic form must be used, but it is not usually employed, except in very small quantities, as a deoxidizer. Antimony is the proper hardener for lead and can be employed up to 20 per cent. Sal-ammoniac is the popular name for ammonium chloride (NH_4Cl), which consists of nitrogen, hydrogen and chlorine. It is a by-product of the manufacture of illuminating gas. A liquid, which is obtained in the course of such manufacture, is treated with lime; ammonia is given off and is passed into hydrochloric acid, thus forming a solution of ammonium chloride, which is then evaporated to crystallization. It is our opinion that it would not be advisable to attempt to make it, especially since it is reasonable in price. Sal-ammoniac is used as a flux for alloys containing zinc as a base.

Brass Ornaments

We would like to have an alloy suitable for brass ornaments which can be given a high polish.

For a good yellow metal the following alloy is recommended: Copper, 70 per cent; zinc, 26 per cent; tin, 2 per cent and lead, 2 per cent.

For an alloy having a golden color, use the following mixture: Copper, 89.5 per cent; tin, 5 per cent; zinc, 5 per cent and lead, 0.5 per cent.

Improved Sand Blast Plant

A sand blast system which embodies several interesting features has been installed by the Tilghman-Brooksbank Sand Blast Co., Philadelphia, at the plant of the Locomobile Co. of America, Bridgeport, Conn. The apparatus, which is employed for cleaning moderate-sized castings and forgings in quantity, is provided with three separate blast chambers. The spent sand and the dust are handled by separate exhaust fans, resulting, it is said, in a saving of 33 1/3 per cent, compared with the one fan system previously employed. A slow speed fan, handling a large volume of air suffices for removing dust, whereas a much higher speed, with consequent heavier suction is necessary, for elevating the spent sand. The saving in power that can be realized by separating these two functions readily may be appreciated.

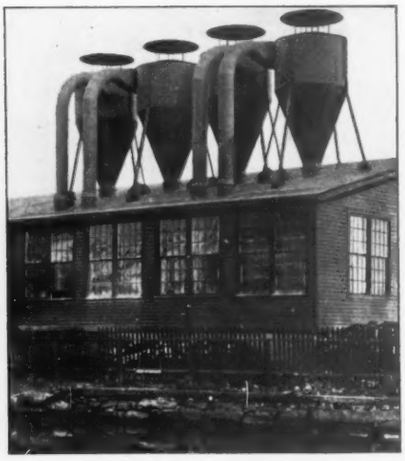


FIG. 1—CYCLONE DUST ARRESTORS ON ROOF OF SAND BLAST BUILDING

In the system installed at the Locomobile plant, four 45-inch steel plate fans of the volume exhauster type are employed. Three, which are operated at a moderate speed, serve to exhaust the dust from the three sand blast chambers; the fourth fan, which runs at high speed, elevates the spent sand from pits located under the blast chambers. All four fans are belt-driven by a single 25-horsepower motor.

The sand elevating system has been improved so that the depth of the pits under the blast chambers has been reduced to 5 feet 3 inches. Instead of the single deep hopper, formerly employed, four pairs of shallow, double hoppers are provided. The opening between each pair of hoppers affords egress for the air containing dust and fine particles of sand. This air is exhausted through a duct which connects with a port located in one corner of the roof of the pit. The heavy spent sand drops down through hoppers into sand elevators of the horizontal type, by which it is carried to the sand settler. The latter is located about 8 feet above the level of the floor of the sand blast chambers. As it enters the settler, the current of sand and air encounters a baffle plate which diverts the sand and permits it to fall to the bottom; at the same time the air and dust pass around the baffle plate and up into the dust collector.

Each of the sand blast chambers is 8½ x 11½ x 8¼ feet in size, the height being given last. The chambers are provided with steel sides and the roofs are plate glass, laid on angle and T-irons. The roof of each chamber is provided with four ventilators which admit fresh air; in order to prevent the egress of flying sand, they are provided with steel baffle plates. The exhaust system provides a complete change of atmosphere in each chamber six to seven times per minute and, as a result, the chambers always are free from dust. The floor of each chamber is ½-inch perforated steel. It is made up in sections 8 inches wide, which may be removed readily for repairs. The floor plates rest on steel I-beams which support the sand blast chambers. The I-beams, in turn, are supported by the 12-inch concrete pit walls. The dust collectors, which are located on the roof of the sand blast building, are steel of the cyclone type manufactured by the Tilghman-Brooksbank company.

The sand blast machines proper are of the improved Tilghman-type which has been on the market for some time. This machine is designed to run continuously and it is not necessary to shut off the air pressure when reloading with sand. The interior of the machine is divided into two compartments which are separated by a valve that is seated by air pressure. When in operation, the sand from the settler flows into the upper compartment of the machine. As soon as it becomes filled it is closed and air is admitted under the same pressure as in the lower compartment, whereupon the valve separating the two compartments is released automatically and the sand flows from the upper into the lower compartment. The machine operates at the comparatively low pressure of 30 to 35 pounds per square inch.

The Canadian Brakeshoe Co., Ltd., Sherbrooke, Que., has placed an order with the Snyder Electric Furnace Co., Monadnock building, Chicago, for an electric furnace which will have a capacity of 24 tons of steel in 24 hours, melting cold material. This steel will be used in the manufacture of 4-inch rounds to be forged into shells for the British government. The Canadian Brakeshoe Co., Ltd., has six electric furnaces in operation, three being of the electrode type. The electrode consumption, it is stated, has averaged about 40 pounds per ton of steel and the power consumption about 1,000 kilowatt-hours per ton. The Snyder electric furnace is being installed under a guarantee as to operating cost. Melting and refining cold material, the Snyder furnace will produce as much steel in 24 hours as is being delivered by four of the present furnaces.

Molding Sand Production

Owing to the depressed condition of the foundry industry in 1914, the output of molding sand aggregated

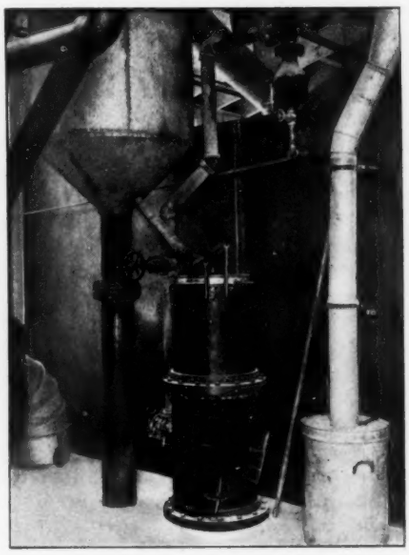


FIG. 2—SAND BLAST APPARATUS IN LOCOMOBILE PLANT

only 2,751,209 tons, as compared with 3,563,583 tons the previous year, a falling off of 812,374 tons or 22.7 per cent. In 1912 there was mined 4,485,380 tons, the highest total ever attained by this industry. The output last year was the lowest since 1908, when 1,980,677 tons were taken from the banks. The value of last year's production was $1,756,383, as compared with $2,230,217 in 1913, a decline of 21.2 per cent in value. It is surprising to note, however, that the average price per ton increased from 63 cents to 64 cents per ton from 1913 to 1914. However, since 1909, when the average price per ton was 68 cents, molding sand has steadily declined in value, having reached an average selling price of 61 cents per ton in 1912. According to a bulletin issued by the United States Geological Survey, Ohio leads with a production last year of 547,398 tons.

Proper Clothing Prevents Injury

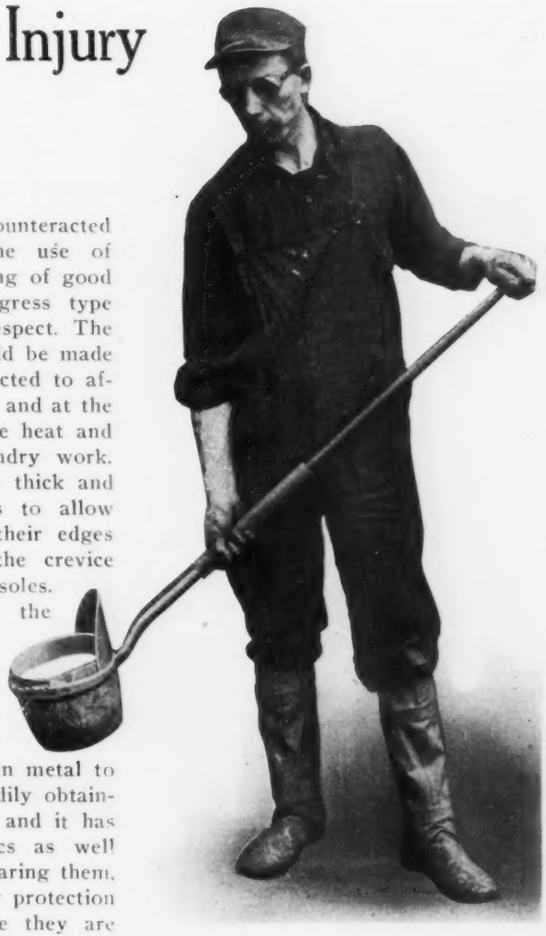
What Foundry Operatives Should Wear in Pursuit of Their Hazardous Occupation

RESPIRATOR WORN WITH HELMET

ANOTHER interesting bulletin, which forms a part of its campaign on accident prevention, entitled "The Use of Proper Clothing to Prevent Injury," has been issued by the committee on safety and sanitation of the National Founders' Association. It is pointed out that in the ordinary activities of life, every one must wear certain forms of clothing to conserve health and avoid injury. The hazards encountered in industrial life are not unlike those in ordinary life, differing only in form or degree, depending largely upon the nature of the work. Where, as in foundries, the handling of molten metal adds somewhat to the usual risk of employment the use of proper clothing, in connection with other protective devices and measures, becomes at once more important, but with their proper use the hazard can be effectively safeguarded.

That hazard in the foundry which has been considered to be most serious because of its frequency, namely, burns of the feet and legs, has been almost completely counteracted in many foundries by the use of proper clothing. The wearing of good foundry shoes of the congress type has helped most in this respect. The uppers of these shoes should be made from leather especially selected to afford comfort and flexibility, and at the same time, to withstand the heat and dampness common to foundry work. The soles should be fairly thick and their edges so tapered as to allow spilled metal to slide off their edges rather than to run into the crevice between the uppers and soles. Of most importance is the elastic goring which should be of a good grade that will not weaken when it is stretched, as otherwise the shoes will gap open at the top and allow molten metal to enter. Such shoes are readily obtainable at a reasonable price, and it has been found that mechanics as well as foundrymen are now wearing them, not only because they offer protection against injury, but because they are also comfortable and economical. All employes should be encouraged to wear shoes of like character, and to this end many employers buy them in wholesale lots and then sell them to their workmen at cost.

Foundry shoes alone, however, can only afford partial protection against molten metal hazards. Leggings, especially designed for foundry service, or the proper kind of trousers worn with bottoms turned down, must do the rest. Most foundry leggings are made of canvas and fully



GOGGLES PROTECT THE EYES, FOUNDRY SHOES AND LEGGINGS PROTECT THE FEET AND LEGS

GRINDERS WEAR GOGGLES TO PROTECT THE EYES, AND GLOVES TO PROTECT THE HANDS

ARC WELDER'S EYES AND FACE PROTECTED BY HELMET WITH COLORED GLASS FRONT

serve their purpose. They are lower in price, lighter in weight and more comfortable to wear than asbestos leggings, which are needed only in special cases on account of their fire-resisting quality. The proper construction of foundry leggings is of primary importance. They must be so made that they can be pulled off without a moment's loss, yet they must fit snugly and comfortably the legs of the average employe to avoid the necessity of keeping a large stock of various sizes on hand. Leggings made of canvas suitably stretched, and secured over spring clips, fill these requirements and present a smooth outer surface free of obstructions, which is an essential feature.

Ordinarily, woolen trousers catch fire less readily than cotton trousers, although the old-fashioned cotton jean pants give good service in the foundry and shed molten metal readily. Thin cotton trousers, unless further protected by leggings, are not a safe proposition in foundry work.

It is, of course, of the utmost importance that the shoes, leggings and trousers worn in foundries should be kept in good condition; otherwise their protective value will be lost and the employe may be caught so much more quickly in the danger trap because he believes himself to be fully protected against the hazard while he is very much exposed to it.

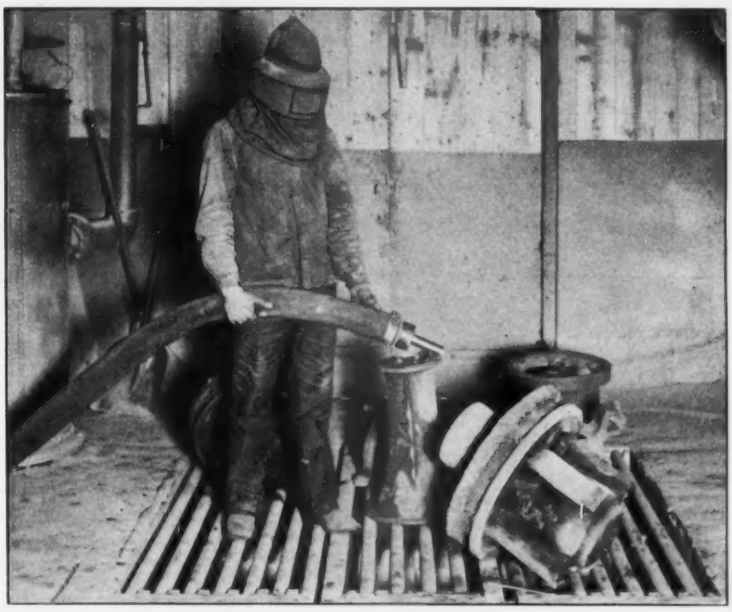
For severe heat conditions around furnaces and ovens, furnacemen may require gloves or other protection for their hands and arms; usually calfskin or buckskin gloves or sleeves will answer this purpose, but in some cases asbestos gloves must be used. It is desirable, however, that these gloves shall not be so thick or so clumsy as to interfere with the safe and easy handling of furnace tools or other appliances. When men pour metal continuously, the ladle shanks are apt to become hot, in which case cheap canvas or leather gloves are used to good advantage; fenders attached to the ladle will minimize the heat and sometimes a short piece of rubber hose is slit and secured to the ladle shank to provide a comfortable hand-grip upon it. Aside from the protection of the feet and legs, the protection of the eyes of foundry employes against splashing of metal when pouring it or flying of chips in cleaning and grinding operations is a matter of deep concern to the foundry manager. Such injuries are frequently severe; too often they cause the loss of the sight of one eye or even of both. While care in handling molten metal and provision against pouring it in damp places will prevent some burnt-eye injuries, yet there is no security against such accidents except through the wearing of safety goggles. Cupola furnacemen especially, who for hours are subject to the hazards of splashing molten metal, need goggles to prevent burns of their eyes; where goggles are worn by all employes while engaged in handling molten metal, a marked diminution and in some cases a complete elimination of

HAND LEATHERS JOINED AT WRIST BY ELASTIC GORING, PROTECT BOTH BACK AND FRONT OF HANDS

LEATHER TO PROTECT THE HANDS WHEN CHARGING OPEN HEARTH FURNACES

burnt-eye injuries has resulted. Open hearth furnacemen require goggles with cobalt blue lenses that will enable them to determine the condition of the metal and yet shield their eyes from its glare. Oxy-acetylene welders and electric arc welders must protect their eyes against excessive glare and heat. The glare of the oxy-acetylene torch is not so intense nor is its heat so great as that of the electric arc and, therefore, acetylene welders' goggles with lenses of a dark green shade are all that are required to protect their eyes from the bright light and from the sparks thrown off from the torch. For the use of electric arc welders, however, the lenses must be considerably denser and are usually made by combining several thicknesses of blue and red, or other colors of glass, set in a helmet worn by the operator to shield his eyes and at the same time protect his face from the heat. Grinders and chippers, whose eyes may be readily injured by flying chips or grit, should always wear appropriate safety goggles while at work; for the same reason repair men should similarly protect their eyes when working inside of cupolas or furnaces. Safety goggles should have large, flawless lenses, ground on both sides, so as not to injuriously affect the vision, and both lenses in any one goggle should be carefully matched to obtain a uniformity of thickness and color. The goggles should fit the wearer's face snugly, though comfortably and have adequate side protectors, which are sometimes made of metal screen and sometimes of perforated leather to afford proper ventilation and yet provide protection against flying particles which might strike the eye from the side. In special cases, like that of men handling acid, and particularly undiluted acid, safety must be insured and ventilation sacrificed even at the risk of temporary discomfort. Goggles are held in place by metal temple bows secured around the ears or by bands fastened about the head. Whichever arrangement is used, care should be taken to have the goggles at all times fit well around the eyes, neither so tightly as to cause discomfort, or so loosely as to leave dangerous openings. Various forms of safety goggles, each suited to its particular purpose, may be readily secured from makers and dealers.

The man who handles pig iron, scrap, rough castings or hot castings will do better work and do it more safely if provided with suitable hand leathers or gloves. Hand leathers may be home-made from scrap leather or from old belting, or may be purchased ready-made; sometimes heavy canvas is used. A form of hand leather that has proved acceptable is composed of two pieces of heavy leather cut to the general shape of the hand and fastened together at the wrist by elastic goring similar to that used in foundry shoes. This hand leather protects both sides of the hand, is held securely to the wrist, is cheaper and yet provides a freer movement of the fingers than a tight glove. When for similar work, added protection against heat or cold is required, gloves may be more desirable. Chippers and grinders wear gloves to good advantage to prevent cutting or bruising of their hands against rough castings or against the grinding wheel; when so used the fingers of the gloves should be cut short to facilitate safe and easy handling of the work. When necessary to wear gloves about moving machinery they must also be fastened snugly about the wrist to prevent contact with moving parts. The nature of the work will have to be considered to determine which forms of hand protectors will prove most serviceable and economical for each purpose. Cheap gloves may be purchased, made either of cotton or canvas; a slightly more expensive but more durable glove is made of a leather known as mule skin; others are made of more serviceable leather, such as calfskin, buckskin and various forms of waterproof and fire-resisting leather. For hard service the front portions of gloves are sometimes provided with leather or metal reinforcement. In connection with pickling processes rubber gloves are used with satisfactory results.



SAND BLAST OPERATOR WITH HELMET

In the latter work employes frequently must use rubber aprons, rubber boots or overshoes, not only to save their clothing, but to prevent injury to themselves. Aprons offer protection in other branches of foundry work; they also add to the comfort of the employe, as when he must carry flasks or rough or hot materials in such a way that they are partly supported against the abdomen or chest, or when grinders similarly support castings against the grinding wheel. The hazards encountered in dusty occupations, unless carefully provided against, may injuriously affect the health of employes engaged in such work. The latter usually do not recognize the necessity of preserving their health, and frequently neglect or refuse to use the devices provided by the employer for their protection. Sand-blasters especially will often neglect the use of respirators for long periods and others are apt to allow the sponges in their respirators to become dry and therefore quite ineffective. The foreman has a peculiar duty in looking after the welfare of these employes, and must make sure that proper health-protecting devices are worn when needed and kept in good condition. Furthermore, he must see to it that only men who are physically fitted for such work are hired for it. In this case particularly an ounce of prevention is far better than the proverbial pound of cure; each man intending to do dusty work should be first examined by a competent physician and not allowed to pursue such employment unless he has been proved to be fitted for it from a physical as well as an efficiency standpoint. Even when so proved,

(*Continued on page 379.*)

THE FOUNDRY

A monthly journal devoted to all branches of the foundry trade

Published by

The Penton Publishing Co.

Penton Building, CLEVELAND

BRANCH OFFICES

BIRMINGHAM, ENG.	Prince's Chambers
CHICAGO	1521 Lytton Bldg.
CINCINNATI	312 Johnston Bldg.
NEW YORK	507 West Street Bldg.
PHILADELPHIA	326 Real Estate Trust Bldg.
PITTSBURGH	2148-49 Oliver Bldg.
WASHINGTON, D. C.	206 Corcoran Bldg.

SUBSCRIPTION

United States and Mexico	$1.00 a year
Canada	$1.50 a year
Great Britain and other Foreign Countries	Eight Shillings
Single Copies	15 cents

Copies published three months or more previous to date of current issue, 25 cents each.

ADVERTISING

All communications relating to advertising copy, discontinuances, etc., must be received on the 10th of the month preceding date of publication.

ENTERED AT THE POST OFFICE AT CLEVELAND AS SECOND CLASS MATTER

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A Reason for Going

SOME readers, and some editors too for that matter, feel that editorials are useful only for filling space. This is *not* a case in point, for this particular editorial has a very definite purpose, namely, *to induce you to attend the foundry convention.* If you have been to previous conventions, or if you have already definitely decided to go to Atlantic City this year, you need not read any further. Instead we would suggest you go down and visit your friend and competitor Smith, who said he "can't see it," and persuade him to go with you.

Perhaps, however, you are one of the minority of foundrymen who have never attended a convention and who really don't see the necessity for it. You are familiar with the benefits that would result from your attendance, but you think you can reap these advantages without taking the trouble to leave your shop. Practically all of the papers, you argue, are published by the leading trade and technical journals, together with full reports of the proceedings, detailed descriptions of the exhibition, etc. Furthermore, the numerous traveling salesmen representing manufacturers of molding machines and other foundry equipment make it their business to see that you do not remain long in ignorance of the latest mechanical improvements. "Why should I bother with the convention and exhibition," you say, "they are both brought to my door?"

Well, we are not going to argue these points with you. We might, but you probably wouldn't appreciate the force of our logic. A man who had never used a telephone could not be expected to have a very just opinion of its usefulness. So we are going to try and give you a new idea.

This year the foundry convention and exhibition will be held at the world's greatest pleasure resort. You may not be interested in the educational advantages of the convention, but you surely have not forgotten how to *play*. You certainly like to chuck the cares of business now and then, and far from the fumes of steaming molds, go in for a rip, roaring healthy good time.

Well Atlantic City's the place this year.

Remember, you may read the printed papers and reports of the convention at home, but—

You can't go swimming in your flask yard, nor is the sidewalk around the plant the best place in the world for an evening promenade.

Trade Outlook

CONDITIONS in the foundry trade are steadily improving and August was the best month of the year. Gradually, the prosperity resulting from the tremendous war orders of the past six months is becoming generally distributed, with the result that all lines of business are feeling the uplift. At the present time foundries specializing in classes of work not directly affected by the demands of belligerents are finding it necessary to increase their melt. Pig iron prices are advancing, with the result that quotations for castings are exceedingly firm and consumers are anxious to cover for their requirements. In the leading centers, No. 2 foundry is quoted as follows: $14.50, Pittsburgh; $14.50, Cleveland; $13.50, Chicago; $15.00, Philadelphia; $14.25, Buffalo; $11.50, Birmingham. Lake Superior charcoal is held at $15.75, Chicago.

Personal

J. L. Simon, who has been treasurer of the Union Malleable Iron Co., Moline, Ill., has been elected secretary, treasurer and acting manager of the company.

Howard A. Lister has resigned as foreman of the core department of the Romeo Foundry Co., Port Huron, Mich., and has accepted a similar position with the Wilson Foundry & Machine Co., Pontiac, Mich.

J. D. Nevius, of Philadelphia, who has been sales representative of a number of foundries during the past 20 years, has organized the firm of Nevius & Baldy, M. D. Baldy being the other partner. Offices have been established in the Manhattan building and the firm is prepared to supply castings of any size and any material from patterns furnished and to quote prices on inquiries accompanied by blueprints and specifications.

W. S. Burgess has disposed of his interest in the Stoddard-Burgess Co., brass and aluminum founders, 426 South Clinton street, Chicago. The business will be continued by E. B. Stoddard. Mr. Burgess will engage in business as a manufacturers' representative in the central west. Prior to his connection with the Stoddard-Burgess Co. he was employed in the capacity of salesman with the Imperial Brass Mfg. Co., Chicago.

J. S. Hibbs, one of the pioneers of the foundry supply fraternity and assistant general manager of the J. W. Paxson Co., Philadelphia, will attend the convention of the American Foundrymen's Association, to be held at Atlantic City. His headquarters will be at the booth of the J. W. Paxson Co., on Young's pier. For many years Mr. Hibbs called on the foundry trade in the central west and he is anxious to renew his acquaintance with his large circle of friends.

Bronze Mixtures Made by Titanium Alloy Mfg. Co.

A booklet, unusual in its text matter and which contains a large amount of valuable information on mixtures and physical properties of 33 alloys manufactured by the Titanium Alloy Mfg. Co., Niagara Falls, N. Y., is being distributed by the bronze department of this plant, which is engaged in the manufacture of titanium, aluminum and other standard bronze castings. In presenting the approximate compositions of the various alloys produced the company states that it is influenced by the feeling that purchasers of high grade bronzes are entitled to know exactly what they are buying, so that they may be in a position to decide whether or not that particular bronze is best adapted to their requirements. Microphotographs of the various bronzes, in uniform magnifications of 20 and 200 diameters, also are included.

A New Gyratory Riddle

The Great Western Mfg. Co., Leavenworth, Kas., has developed a new motor-driven gyratory riddle the details of which are shown in the accompanying

IMPROVED GYRATORY FOUNDRY RIDDLE

illustration. It is said that this machine retains all of the desirable features of the previous Combs riddles and in addition contains a number of improvements which add appreciably to the efficiency of the device. The new machine is constructed entirely of metal, resulting in a reduction in weight coupled with an increase in strength. The number of bearings has been reduced from six to three and the motor is totally enclosed. Special attention has been given to the design of both the motor and bearings in order to effectually protect them from dust; also the design is such that true gyratory sifting motion is readily obtained without the use of gears. The sieve, which is 20 inches in diameter, is of all-metal construction. It is held in place by an improved clamping device which enables the operator to remove the sieve, dump and replace it with a minimum of effort. The motor, which is only 1/6-horsepower, can be operated from any standard lighting circuit.

It is said that this machine will clean more sand than 10 laborers using hand riddles. As indicated in the illustration, the machine may be suspended from a trolley running on a wire cable stretched parallel with the line of molders. In this case the machine is pushed from point to point as it is needed, and it is claimed, as many as 20 molders may be supplied with sand in this manner. The riddle also may be mounted between two molding machines or in any other convenient manner. If desired it can be arranged so that the sand is sifted directly into a flask, or into a wheelbarrow.

Proper Clothing Prevents Injury

(*Continued from Page 377*)

he should be similarly re-examined at frequent intervals, so that if any previously undiscovered weakness should develop symptoms of lung trouble, the health of the man may be protected by prompt medical treatment and by change to open air work.

It is not only essential that workmen should wear clothing that affords safety as well as comfort in their employment; it is equally important that such clothing should be kept in good condition and worn in a safe way. Foundry shoes or any other kind of shoes are unsafe if their soles are worn so thin that nails, slivers or turnings will easily cut through, or if their uppers are cracked or if the goring gaps so badly as to invite molten metal to enter the shoe. Loose, ragged or turn-up trousers are a menace when worn in the foundry. The men who wear loose belts, ripped and holey gloves, dangling sleeves, flowing neckties or other loose or torn clothing when working about moving machinery invite disaster to themselves. Many injuries have been reported which have been caused by contact of moving machinery with finger rings worn by mechanics; such rings should not be worn by men who work where such a hazard exists. Repairmen who must work in high positions in the midst of moving pulleys, shafting and belts need to be particularly careful in this respect, and should keep their clothing snugly buttoned or belted; tightly fitted leather leggings, closely buttoned jumpers with short sleeves and a generally trimmed for action

and a generally *trimmed for action* condition will facilitate their work and allow them to do it with reasonable safety.

When a man wears proper clothing he feels comfortable; he can then work at his best. Many workmen readily recognize the common sense of thus adding to their efficiency while protecting themselves from injury. Others, however, will need to have these advantages pointed out to them in a friendly way, but in some cases the foreman must use more forcible measures.

While it must always be made clear to workmen that the cautious way of doing their work is the safe way, they must also be taught that even the cautious man can work most safely and do his best work when he uses safe appliances and wears safe and comfortable clothing.

A Fibre Helmet for Welders

In the accompanying illustration is shown a new type of helmet for arc and autogenous welders, which is made of a special hard black fibre treated to resist high temperatures and to retain its shape. The advantage obtained by the use of fibre for this purpose is due to the fact that its heat absorbing property is low, thereby greatly reducing the temperature inside the helmet. It is claimed that temperatures inside of metal helmets as high as 300 degrees Fahr. have been recorded, whereas in fibre helmets, doing the same work, the highest temperature attained is only 100 degrees Fahr. Since the fibre is a non-conductor of electricity, regardless of how careless the wearer may be in permitting his helmet to make contact with the welding circuit, danger from electric shock is eliminated. Furthermore, the weight of the helmet is much less than that of one made of aluminum or wood and as the fibre is exceedingly resilient, it will not lose its shape from hard usage, nor is it readily broken. The steel cylinder shown in the accompanying illustration is provided for the purpose of preventing the intense rays of light from striking other workmen in the plant. This helmet is manufactured by the Julius King Optical Co., New York City, maker of goggles and other safety devices for the use of foundry, machine shop and steel works operatives.

The Reading Steel Casting Co., Reading, Pa., has recently completed a new welfare building for the use of its employes. The structure cost more than $12,000. It is virtually a completely equipped clubhouse. A ball room, reading room, correspondence room, kitchen and locker room are provided, together with other facilities found in first-class clubhouses. The Reading Steel Casting Co. employs approximately 250 men and the new clubhouse is managed by an employes' association, of which William Schambach is president.

Molding Sand

By W. J. Keep

Question:—We have been wondering recently whether good molding sand is more difficult to obtain at the present time than formerly, or whether this situation is peculiar only to our own experience. We would like to know whether artificially mixed sand

ARC-WELDER AT WORK WEARING FIBRE HELMET

is as reliable as the natural product and we are wondering whether foundries dry and bolt as much sand now as formerly.

Answer:—For molding purposes natural sand, of course, is the most satisfactory and sand for fine work is obtained from a comparatively limited number of deposits. It never, however, has been as difficult to obtain sand for machinery castings as for light castings having highly finished surfaces and which necessitate the use of fine sand. Foundries making machinery castings require such a variety of coarseness and bond that they generally can obtain a fair quality of sand from banks not distantly located from their plants and can temper it to suit their requirements. Clay wash will increase bond and seacoal will prevent burning. Furthermore, machinery molders become expert in mixing facing sands to apply next to the patterns. When the mold is skin-dried, the surface can be sprayed to give the mold as much firmness as desired.

Your inquiry evidently relates to the use of natural sands for thin castings which will require no further treatment by the molder than riddling and which are used for facing purposes. If you purchase your sand from the well-known fine sand districts, you need not give the chemical composition consideration, as it will not measure up to the ideal in any event. However, carefully selected sand from such deposits will give satisfaction even if it does not contain the exact theoretical quantities of the various elements desired to give the best results.

Artificial Sand

Abroad some of the finest castings made were molded in artificial sand which was produced by crushing sand stone and adding fire clay wash to hold the sand together. The base of molding sand is silica in grains which are very irregular in surface contour, but uniform in size, having sharp, angular edges. When such grains have a very small amount of moist loam attached to their rough surfaces, they can be crushed together to interlock and at the same time leave sufficient free space through which steam and gas can escape.

Referring to the ideal. In the best grade of molding sand the grains must never have had their sharp angles worn off by the movement of water or wind or by grinding in the mill. This explains the difference between the best natural sand and inferior grades. The grain structure and just the right amount of binder are of the utmost importance and overbalance the importance of the presence of a very small amount of iron, or lime. The iron in silica sand which gives it the color of light brown sugar and the small amount of lime usually present in the sand, as a rule, will not overbalance the importance of good physical structure. While I am unable to assign any reason for it, it seems that the best molding sand contains small particles of mica, which will glisten in a cross light.

The molding sand taken from the deposits along the Hudson river and near Lake Erie are similar, but the latter are a trifle coarser than the Hudson river sands and contain slightly less bond. The sand deposits along the Ohio river are of a finer grain than those previously noted and contain a sufficient amount of bond. The deposits of sand inland and north of the river contain more bond and

are stronger. The sands which are coarser and vent more freely are better adapted for stove covers and tops, but wear out very quickly. One of the troubles experienced from the use of fine grain sands containing a fairly high percentage of loam is that they will give excellent results at first, but after the silica grains wear smooth and the excess of loam closes up the vents, trouble is experienced. The only remedy is to stop its use and to add to the heaps an open, coarse sand. It has been my experience that it is not advisable to use a sand that is too fine, but to employ one that is coarser and more open, as in the long run it will make more smooth castings with less burned surfaces than very fine sand.

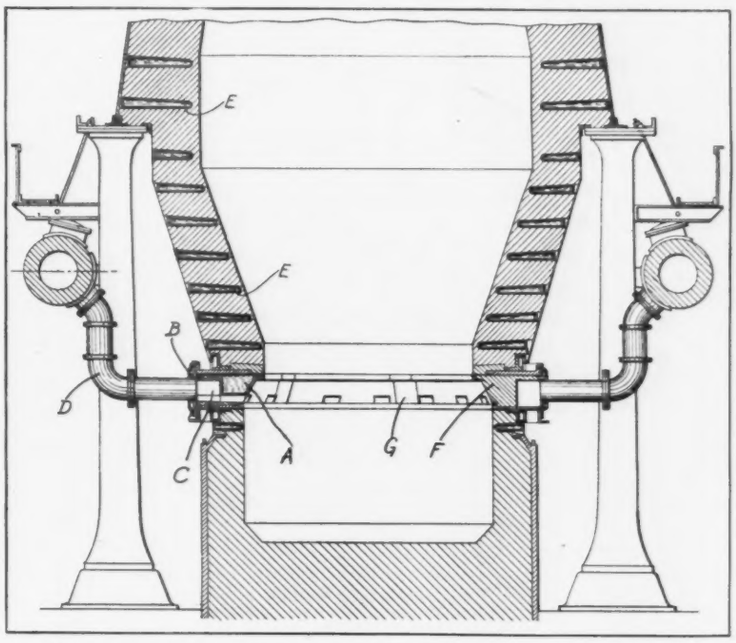
Grading Sand

The grading of sand, to insure delivering to the foundryman the exact grade of sand adapted to his work, involves considerable experience and the careful study of individual foundry needs. In some sections of the country the sand from one mound is not of uniform grade and the sands in different mounds vary widely in quality. Fortunately, these sands can be graded by experts employed for this purpose and their skill is truly remarkable. In the west, except near Lake Erie, the deposits are deep and the various grades are separated by layers of sharp sand of nearly the same color. However, none of this should be permitted to be mixed with the molding sand. This indicates how difficult it is for inexperienced operators to engage in the development of new deposits and to grade sand to meet particular foundry requirements. Molding sand should never contain stones or lumps of clay.

Every car of sand received by a foundry should be carefully inspected as a car of poor sand unloaded into the bin will cause trouble for a long time in the sand heaps. Artificially mixed sand should be satisfactory for the purpose for which it is intended and if it is not, it is because the grains or the proportion of loam in the mixture is not correct, or because it has not been given the proper treatment. In drying the sand it may be burned, and in grinding or mixing, the sharp edges of the grains are liable to be rounded. Such sand will wear out quickly. The old method of drying the sand on metal shelves over steam pipes and then mixing it in a machine having reciprocating blades gives excellent results, but this practice proved unsatisfactory in large shops where the tonnage of sand consumed is great.

Invents New System of Tuyeres

A cupola tuyerage system with double water-cooling of the tuyere section, water-cooled bosh plates, and blast chambers so arranged as to baffle the blast before it enters the furnace, has been invented by Francis J. Zippler, Pittsburgh and will be furnished to the foundry trade by the J. W. Paxson Co., Philadelphia. In the Zippler design, the bosh plates are made in hollow section so as to form a series of water jackets. The principal water jacket surrounding the tuyeres is built in segments designed to be easily removable in case of breakage of any portion. This practice also permits the use of solid sections between the tuyere blocks. These sections may be either integral with or separate from the tuyere blocks and the water jacket segments, and relieve the latter from the weight of the furnace walls above. The tuyere section is further cooled by a surrounding water jacket band. To baffle the hot blast before it enters the furnace, the supply pipes are staggered with the tuyere openings, the blast striking the outer face of the tuyere water jacket and being sharply deflected. Each tuyere draws its supply of air from an annular chamber thus fed by the supply pipes. The furnace also is provided with tapered inserts between the tuyere blocks, to prevent molten metal from running back into the tuyeres and supply pipes. In the accompanying illustration, *A* indicates a section of the segmented, principal water jacket; *B* the water jacket band surrounding the tuyere section; *C* the annular blast chamber; *D* a supply pipe; *E* the hollow, water-cooled bosh plates; *F* the tuyere blocks, and *G*, the solid supporting sections between the tuyere blocks. This tuyerage system is claimed to afford economies in coke consumption.



CROSS-SECTION OF ZIPPLER WATER-COOLED TUYERES FOR CUPOLAS

Detroit Metal Refining Co.

The Detroit Metal Refining Co., Detroit, has taken over the Keeton works in that city and has converted it into a smelting plant for the refining of white metals and alloys. Sol Sadek, who was general manager of the Progressive Metal & Refining Co., Milwaukee, will direct the business of the new company and while his future residence will be at Detroit, he will retain his interest in the Progressive company. The Keeton plant has been completely remodeled and modern equipment has been installed in its 2½ acres of buildings. The melting facilities include a battery of 48 furnaces. The officers of the company follow: I. Gerson, Toledo, president; L. R. Grosslight, Detroit, treasurer; S. Gerson, Toledo, secretary, and Sol Sadek, general manager.

Production of Pig Iron

Pig iron production during the first half of 1915, according to statistics issued by the American Iron and Steel Institute, aggregated 12,233,791 tons, as compared with 12,536,094 tons the first half of 1914 and 10,796,150 tons the second half of last year. The output of foundry iron during the first six months of this year aggregated 2,207,375 tons, as compared with 2,454,540 tons the first half of 1914 and 2,078,714 tons during the last half.

Troubled With Dull Iron

By W. J. Keep

Question:—We are experiencing considerable difficulty resulting from dull iron. Our cupola is lined to 60 inches and is equipped with 12 lower tuyeres, 4 x 8 inches, and six upper tuyeres, 3 x 4 inches. At present we melt about 20 tons daily. Our charges consist of the following: Bed, coke, 2,400 pounds; pig iron, 3,000 pounds and scrap, 2,000 pounds. The eight additional charges consist of coke, 375 pounds; pig, 2,000 pounds and scrap, 2,000 pounds. We use a 15-ounce blast and the bed extends to a height of about 20 inches above the upper tuyeres. The fire is lighted at 11 o'clock and the blast is put on at 2:45 P. M. Our iron comes in from five to seven minutes and we drop bottom at 4:25 when we melt 18 tons. We are using a 72-hour brand of coke.

Answer:—First stop-off the upper row of tuyeres and light your fire at 12 o'clock, which will give you 2¼ hours to heat the cupola before the iron is tapped. However, two hours should be sufficient. The coke should extend to a height of from 15 to 20 inches above the tuyeres before you begin charging. Lighting the fire so early probably burns the bed more than you calculate. The next time the cupola is lined make the tuyeres inside of the lining much wider than they are at present, approximately 12 inches instead of 8 inches. Probably after the first charge, 3,000 pounds of iron and 275 pounds of coke would give better results. After you close the upper tuyeres you figure the height of the bed when you begin charging iron as 20 inches above the lower tuyeres.

Scale-Burnt Malleable Castings

By Richard Moldenke

Question:—How can we avoid the burning of scale onto malleable castings during annealing? These casting are milled clean in the hard, but after tumbling in annealed form it is difficult to remove the scale. Our packing mixture consists of mill scale and drillings with some slag and coke dust. The annealing period is 72 hours and the maximum temperature obtained is 1,600 degrees Fahr.

Answer:—The burning of scale onto malleable castings is due primarily to poor melting practice, the metal being oxidized slightly in the air furnace as a result of long heats. This causes an open structure which cannot resist the long continued application of high annealing temperatures. First of all, the heats should be shortened as much as possible. Next, pack the castings carefully, rapping the pots while carrying on this operation to pack the scale closely together. Unless this is done air currents will pass up through the mass of castings and scale, the metal becoming oxidized and the scale adhering to the castings. Furthermore, the metal *wastes* and sharp corners and edges are conspicuous by their absence.

Scale mixed with drillings will serve your purpose satisfactorily, but coke dust is not required as an admixture. Slag and mill scale mixed form an excellent packing material to melt the castings and to make them stick together. Use either the slag or all mill scale and iron. A temperature of 1,600 degrees Fahr. is vague unless an explanation is made of how this reading is obtained. If this is the temperature of the oven itself, it is probably correct, although the temperature of the pots may be 200 degrees below this figure. The only proper method of taking the temperature in malleable annealing is to ascertain it at the coldest point and at the coldest pot in the oven, which usually is near the bottom in front. The pyrometer must be protected against the sweep of the flame and gases and you should obtain the pot temperature only by actual contact with it. Ordinarily the burning of scale onto castings results from a combination of the foregoing troubles and close attention to melting, packing and the scale itself will correct this difficulty. It is not unusual for the men to become careless and the shop practice suffers in consequence.

Edward E. Walker has been elected vice president of the Erie Malleable Iron Co., Erie, Pa., to succeed his father, the late B. J. Walker. E. E. Walker was superintendent of the plant prior to this recent election.

Device for Removing Iron From Sand

By Inquirer

While we never have known of a device being developed to remove gaggers and iron particles from waste core and molding sand satisfactorily, we have been wondering whether any magnetic device ever has been developed for this purpose. In our plant the gaggers, nails and other iron particles are picked out of the sand by hand, entailing a large amount of work. We know that in some plants in which electric magnets are installed, these are passed over the heaps and a large amount of these ferrous particles adhere to the magnet, thereby greatly eliminating hand labor. However, we have been wondering whether a satisfactory device has been developed which could accomplish this work other than a lifting magnet. We, of course, know that gaggers, etc., are recovered when the sand is screened, but we want to eliminate all such work in the recovery of this iron from our waste core and molding sand.

The value of fire brick produced in the United States last year was $16,427,547, as compared with $20,627,122 in 1913, a decrease of $4,199,575. The value of fire brick last year comprised 12.68 per cent of the value of all brick and tile products. Pennsylvania is the leading state in fire brick production and including silica brick, the value of this product totaled $7,836,503.

At a meeting of the Council of the British Foundrymen's Association held at Leeds, Eng., July 10, appropriate resolutions were adopted over the great loss sustained by the foundry industry of the world through the death of the late Thomas D. West.

NEW TRADE PUBLICATIONS

LUBRICATION OF PNEUMATIC TOOLS.—An 8-page bulletin, recently issued by the Chicago Pneumatic Tool Co., Chicago, discusses the lubrication of pneumatic tools and describes automatic oilers adapted to their various pneumatic devices. A grease machine also is shown.

CENTRIFUGAL PUMPS. — The double suction vertical centrifugal pump built by the A. S. Cameron Steam Pump Works of the Ingersoll-Rand Co., New York City, is illustrated and described in a 16-page bulletin. Sectional views are included showing in detail the construction of this type of pump and open impeller types also are illustrated and described.

SPECIAL PATTERN EQUIPMENT.—The Moser Pattern & Foundry Co., Newark, O., has issued a 12-page booklet devoted to the special service which it is prepared to render to the foundry trade in the manufacture of wood and metal patterns for stoves, heaters, furnaces and machinery, aluminum and steel matchplates for split patterns, molding machine plates and stove cover pattern plate outfits.

CUPOLAS.—The Central Foundry Supply Co., Columbus, O., has issued a 20-page catalog devoted to the Colliau cupola and the necessary equipment for this furnace. The latter includes blast gages, cupola linings, blowers, etc. The Vulcan cupola also is shown, which was designed to meet the demand for a furnace of medium price. This

catalog contains a large amount of data which should prove of great interest to foundrymen generally.

OIL SWITCHES.—In a recently issued bulletin the General Electric Co., Schenectady, N. Y., describes oil switches for use on voltages up to 2500. These are built in three capacities, non-automatic and automatic for use on two, three and four-wire systems and for current up to 300 amperes. The bulletin contains illustrations and diagrams of the various styles of switches.

GRAPHITE BRUSHES. — A booklet devoted to graphite brushes has been issued by the Joseph Dixon Crucible Co., Jersey City, N. J. It is claimed that a large percentage of the breakdowns in motors or generators is due to the improper operation of commutator and brushes. This booklet explains how the characteristic lubricating qualities of graphite are utilized to eliminate the shutting-down of the electrical plant. Graphite brushes are recommended in preference to carbon.

ELECTRIC ARC WELDING.—An exceedingly instructive, 24-page catalog, devoted to welding by the electric arc, has been issued by the Lincoln Electric Co., Cleveland. The subject of welding, with particular application to the performance of this work electrically, is discussed at length and many illustrations are included showing castings and other metal parts electrically-welded. The instructions on arc welding generally contained in this work should prove of value to all foundrymen.

PATTERN SUPPLIES. — The Wellman Pattern-Supply Co., Cleveland, has issued a comprehensive 44-page catalog covering a complete line of pattern shop supplies including white metal and brass pattern letters and figures, pattern letter cases, fillets, brass and wooden dowel pins and core box pins, rapping plates, fillet tools, pattern lumber, clamps, vises, pinch dogs, etc. A number of special pattern shop tools including jointing machines, band saw grinders, etc., also are illustrated and described.

OVERHEAD CARRYING EQUIPMENT. —The Richards-Wilcox Mfg. Co., Aurora, Ill., has issued a 32-page catalog describing and illustrating its line of overhead trolley and I-beam carrying equipment. The advantages of an overhead carrying system in foundry operations are pointed out in detail and a number of service views are presented showing the company's equipment in operation. In addition the catalog contains drawings, tables and illustrations giving in detail the principal features of the equipment manufactured.

PNEUMATIC TOOLS. — Three bulletins have been issued by the Ingersoll-Rand Co., New York City, devoted respectively to floor and bench rammers, plug drills adapted for operations on stone, granite, etc., and another type of drill adapted for operations on metal and wood. The floor and bench rammers are used for making molds and also can be applied in concrete work. In foundries their use effects great economies since they prove less tiresome to the operator than the employment of hand tools. The drill for metal and wood operations is described in detail and various sizes and types are shown. Numerous service views also are included.

PORTABLE TOOLS.—In a 20-page folder issued by the Stow Mfg. Co., Binghamton, N. Y., its extensive line of portable tools is illustrated and described. This includes the following: Two-spindle drill, electric breast drill, universal drill, drill for heavy work, tool post grinder, electric bench grinder, electric hand buffer, portable screw driver, center grinder, radial flexible boring machine, suspended drill, portable emery grinder, motor-driven general utility tool, flexible shaft drilling combination and the flexible shaft combination for use with a scratch brush. All of these tools are motor-driven and are adapted for use in foundries, machine shops and other industrial plants.

ELECTRIC GRINDERS. — An eight-page bulletin issued by the Chicago Pneumatic Tool Co., Chicago, is devoted to its line of electric grinders especially adapted for use in foundries, machine and structural shops. While these grinders have been on the market for several years, they recently have been improved materially by the incorporation of a new ventilating system for the windings and three ball bearings for the shaft or arbor, with excellent provision for lubrication. The grinders illustrated and described include heavy duty portable; universal portable, direct or single-phase alternating current; universal portable surface; tool post, pedestal and electric precision types.

AIR COMPRESSORS.—The Gardner Governor Co., Quincy, Ill., has issued two bulletins devoted respectively to horizontal single-cylinder air compressors, and vertical air-cooled compressors and vacuum pumps. The single-cylinder compressor is of the horizontal self-oiling type which will permit of high speeds thus affording an increase of 33⅓ per cent in capacity. The machine can be arranged for motor or belt drive and a steam-actuated compressor also is built. The vertical, air-cooled compressors are adapted for compressing air in small quantities at low pressures. The air cylinder is provided with radiating flanges, dispensing with the necessity of water circulation. Electrically-driven outfits also are shown, as well as air wagon types and one-tool plants. Vacuum pumps also are described.

PATTERN LETTERS AND FIGURES.—A 28-page catalog and price list of white metal and brass pattern letters and figures has been issued by H. W. Knight & Son, Seneca Falls, N. Y. This company also manufactures wood and leather fillet, steel letters and figures, dowels, rapping plates and branding irons. The white metal pattern letters furnished to the foundry trade by this company may be bent to conform to the contour of patterns or steel brads may be driven through them into the patterns for holding them in place. Interesting suggestions are included regarding the uses of pattern letters and the lettering that should appear on castings. Directions are given for sweating brass letters to iron patterns, as well as for fastening white metal letters to iron patterns. Hand made steel letters are described, as well as soft lead gaskets, copper burning brands, etc. This catalog will prove a valuable addition to the business library of every foundry and pattern shop.

WELDING AND CUTTING EQUIPMENT.—The welding and cutting equipment built by the Prest-O-Lite Co., Indianapolis, is illustrated and described in a series of bulletins contained in a loose-leaf binder. One of these bulletins entitled "Fusion or Autogenous Welding" briefly describes the various processes of electric, oxy-hydrogen, oxy-coal gas and oxy-acetylene welding and cutting, with a chapter on metal cutting by oxygen. The welding apparatus built by this company is described in an eight-page bulletin and another bulletin of 20 pages points out how the cost of manufacturing processes in the metal industries may be lowered by repairing broken and worn equipment by oxy-acetylene welding and cutting. This bulletin contains a large number of interesting service views showing the application of the Prest-O-Lite equipment for welding rolled steel parts, cast iron and for cutting steel. Illustrations of a wide assortment of repairs made by this process are included, which reflect the wide adaptability of this equipment in various classes of work.

WHAT THE FOUNDRIES ARE DOING

Activities of the Iron, Steel and Brass Shops

The Saturn Machine Co., Wheeling, W. Va., will install and equip a brass foundry.

The Michigan Steel Casting Co., Detroit, has increased its capital stock from $210,000 to $280,000.

The United States Malleable Iron Co., Toledo, O., has increased its capital stock from $150,000 to $250,000.

The Waynesboro Foundry & Machine Co., Waynesboro, Pa., has been incorporated with a capital stock of $30,000.

The Salmon Bay Foundry Co., Seattle, Wash., has been incorporated with $6,000 capital, by John Wehn, S. Redick and others.

The plant of the Gray Iron Foundry Co., Reading, Pa., has been sold to H. Claude Bell, of the Reading Casting Co., for $14,000.

The Gate City Foundry Co., Kansas City, Mo., has been incorporated with $12,000 capital, by William L. Karnes, T. J. Sheldon and N. D. Barr.

The Adolph Leitelt Iron Works, Grand Rapids, Mich., has been incorporated with a capital stock of $500,000 to engage in a general foundry and machine shop business.

The capital stock of the General Aluminum & Brass Mfg. Co., Detroit, has been increased from $150,000 to $400,000. The company manufactures brass and aluminum castings.

The Alton Foundry Co., Ltd., Alton, Ont., Can., has been incorporated with $50,000 capital, by Andrew Dods, 35 High Park Gardens, Toronto; J. M. Dods, Alton, and John M. Deagle, Cataract, Ont.

The Komo Mfg. Co., Kokomo, Ind., has been incorporated with a capital stock of $100,000 and has taken over the foundry and machine shop of Ford & Donnelly. O. K. Cole, B. D. Cole and Howard Cole are the incorporators.

Jas. A. Taylor, owner of the New Lebanon Foundry, East Port Chester, Conn., has ac-

quired an old chemical plant at Bridgeport, Conn., and has equipped it as an iron foundry. The East Port Chester plant will continue to operate.

The South Park Machinery & Supply Co., Port Huron, Mich., has been incorporated and will take over the business of the South Park Mfg. Co. A brass foundry and machine shop will be operated. The incorporators are S. F. Connor, E. V. Vanness and E. L. Moak.

The Simmons Metal Goods Co., 1122 Superior avenue, Cleveland, has been incorporated with $25,000 capital to operate a brass, bronze and aluminum foundry, brass machine shop, grinding room and stamping and brazing department. D. Hilden and J. W. Simmons are incorporators.

The Sanitary Mfg. Co., Kenova, W. Va., has been incorporated with a capital stock of $300,000 by O. M. Bake, H. R. Wyllie, D. E. Abbott and John T. Davis. The company has acquired a portion of the plant of the Independent Steel Co. and will install a brass foundry and machine shop.

The Dudley Electrical & Machine Co., Uniontown, Pa., has been incorporated with a capital stock of $50,000 to engage in the manufacture of boilers, castings and electrical machinery. The incorporators are W. E. Dudley, 104 East Main street, Uniontown; Elwood D. Fulton, W. D. Woodriff, J. T. Dudley, Harry E. Street and Lucy Fulton.

The Elmwood Castings Co., Elmwood Place, Cincinnati, has been reorganized and incorporated with a capital stock of $100,000. Officers have been elected as follows: H. M. Ramp, president; George Deems, vice president; Joseph Weber, secretary and Louis B. Weber, treasurer. The company has leased the foundry of the Lane & Bodley Co. at Bond Hill, which it will operate in addition to its plant in Elmwood.

The E. A. Stege Mfg. Co., operating a plating and brass works, and the Rindt Co., brass founder, both of Louisville, Ky., have consolidated and will be known as the Stege-Rindt Plating Co. The company is capitalized at $11,000 and the incorporators are Louis Rindt, president; Louis C. Stege, vice president; George W. Stege, secretary-treasurer, and Carl Rindt and Capt. C. H. Huhlein, president of B. F. Avery & Sons, directors.

The Cleveland Manganese Silver Metal Co. has been organized to engage in the manufacture of white metal castings. The foundry at 9001 Desmond avenue, Cleveland, formerly operated by the Gordon Propeller Co., has been leased for temporary use. The company intends to purchase a site on the Belt line and will build later. It will be in the market for additional equipment in the near future. C. F. Johnson, president; William Kemter, vice president; Emil Kraus, secretary and treasurer, and H. R. Gaskill are the organizers. The company claims that its product will not corrode or tarnish, while the machining qualities are equal to those of good brass. An office has been established at 313 Cuyahoga building, Cleveland.

New Construction

The Hancock Mfg. Co., Charlotte, Mich., contemplates enlarging its foundry.

The Lansdale Foundry Co., Lansdale, Pa., is erecting an addition to its foundry.

Klein & Anger, Madison, Ind., are erecting a foundry and are buying equipment.

The Eynon-Evans Mfg. Co., Fifteenth & Clearfield streets, Philadelphia, will build a three-story foundry and machine shop, 50 : 120 feet, with a wing, 58 x 128 feet.

The Erie Malleable Iron Co., Erie, Pa., will erect an annealing plant, 126 x 278 feet.

The American Skein & Foundry Co., Racine, Wis., is building a $10,000 addition to its plant.

The American Rotary Valve Co., Anderson, Ind., contemplates the erection of an addition to its foundry.

The Whitcomb-Blaisdell Machine Tool Co., Worcester, Mass., will build a foundry at a cost of $4,500.

The Galion Iron Works & Mfg. Co., Galion O., will build a 60 x 64-foot addition to its foundry.

The Smith-Matthews Foundry Co., Detroit, Mich., will erect an addition to its plant at a cost of $1,000.

The foundry of Campbell & Kelly, Inc., Tonopah, Nev., recently damaged by fire, will be rebuilt.

A $500,000 addition will be built at the plant of the Baltimore Car & Foundry Co. at Curtis Bay, Md.

The Rome Brass & Copper Co., Rome, N. Y., will build a 1-story, 140 x 200-foot addition to its foundry.

The Manufacturers Foundry Co., Waterbury, Conn., will build a 1-story, 30 x 30-foot addition to its foundry.

The plant of the Louis Sacks Foundry Co., Newark, N. J., will be extended by the erection of a 1-story addition.

The Duncan Mackenzie's Sons Co., Trenton, N. J., is extending its iron foundry by the erection of an addition.

The H. Root Foundry Co., 1749 Ballou street, Chicago, will build a 1-story addition to its plant at a cost of $2,000.

Harry Alldis, Chehalis, Wash., will erect a foundry and machine shop to replace his plant recently destroyed by fire.

The Lake Erie Refining & Smelting Co., 7800 Bessemer avenue, Cleveland, will build a one-story, 30 x 55-foot foundry.

The Valley Mould & Iron Co., Sharpsville, Pa., is erecting large additions to its foundry which will double the capacity.

The Syracuse Malleable Iron Works, Syracuse, N. Y., contemplate extending their plant by the erection of three buildings.

Plans have been completed for the erection of a 1-story brick addition to the foundry of the Bridgeport Brass Co., Bridgeport, Conn.

The Johnston & Jennings Co., Cleveland, will build a $5,000 foundry addition at Addison road and the New York Central tracks.

The Williams Foundry & Machine Co., Akron, O., will build a 2-story, 92 x 125-foot addition to its machine shop at a cost of $15,000.

The Schuylkill Haven Pipe Foundry Co., Pottsville, Pa., will rebuild its plant, recently destroyed by fire, at a cost of approximately $50,000.

A contract has been awarded to Edgar E. Kringlen for the erection of a $10,000 building for the Billings Foundry & Machine Co., Billings, Mont.

The French Creek Foundry Co., Franklin, Pa., will erect an $18,000, 1-story, 70 x 150-foot building to replace the one recently destroyed by fire.

The Phoenix Iron Works Co., Meadville, Pa., has increased its capital stock from $200,000 to $300,000 and will erect a large building to house the plate shop, foundry and boiler departments.

A new plant, including a repair shop, boiler and pump house and a foundry, will shortly be erected on Denison avenue, Cleveland, for the Cleveland Railway Co. The cost will approximate $13,000.

Plans are being prepared for the erection of an addition to the foundry and machine shop of the Shelby Tube Co., Ellwood City, Pa. Work on a new 240 x 600-foot addition is partially completed.

Smith & Winchester Co., South Windham, Conn., will erect a one-story, 69 x 85-foot foundry in Windham. Adolph Suck, 97 Arlington street, Hyde Park, Mass., is the architect.

The Crompton & Knowles Loom Works, Worcester, Mass., will build a one-story addition to its foundry. When finished, work now being done at the old Star foundry will be transferred and that plant closed.

The Tulsa Engine & Foundry Co., Tulsa, Okla., recently incorporated with $50,000 capital to engage in the manufacture of engines, hay balers, ventilating machinery, etc., contemplates the erection of a foundry.

H. P. Mueller, brass founder, 219 Lombard street, St. Louis, is erecting an addition to his foundry, 113 x 48 feet. He is in the market for a rolling drawer core oven of the brick type, as well as coremaking machines.

Architect William F. Burfeind, 28 East Jackson boulevard, Chicago, is taking bids on a $50,000, two-story foundry and warehouse, 124 x 125 feet, to be erected for the Western Plumbing & Supply Co., 119 North Desplaines street, Chicago.

The Gartland Toledo Foundry Co., Toledo, O., has been incorporated with $80,000 capital by M. F. Gartland, John C. Haswell, T. H. Gartland, R. S. Holbrook and William L. Holbrook. The company has purchased a tract of 80 acres in Ironville and will erect a foundry, 100 x 430 feet.

The American Enamel Mfg. Co., 171 Madison avenue, New York City, has purchased the old plant of the Colwell Lead Co., at Elizabeth, N. J., and will erect 12 buildin for the manufacture of cast iron pipe and fittings, enameled bath tubs, etc. John A. Lefferts, formerly superintendent for the Colwell company, has been appointed local manager.

The Gravois Foundry & Mfg. Co., St. Louis, Mo., recently incorporated to engage in the manufacture of castings and patterns, is erecting a one-story plant, 60 x 150 feet, at Thirty-eighth and Delor streets. The building will be of steel frame with walls almost entirely of glass. Isaac Jones is president, Thos. C. Gundelfinger, vice president and secretary and Frank J. Kroupa, treasurer.

The Hewitt Bearing Metal Co., Inc., Newark, N. J., manufacturer of brass and bronze castings, as well as bearing bronzes, is erecting a new fireproof foundry to replace the plant recently destroyed by fire. The new foundry, which is nearing completion, will have double the capacity of the old shop and will be equipped to handle the requirement of the trade with greater dispatch than heretofore.

The Greentown Aluminum Co., Greentown, O., has been incorporated with $25,000 capital stock to engage in the manufacture of aluminum cooking utensils. Plans are being prepared by W. C. Owen & Co., 449 Leader-News building, Cleveland, for a $10,000, one-story building, 36 x 114 feet. A. C. Myers is president and the other incorporators are R. P. Hoover, C. K. Donat, F. O. Boston and H. O. Weary.